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Issue #67 July 1992

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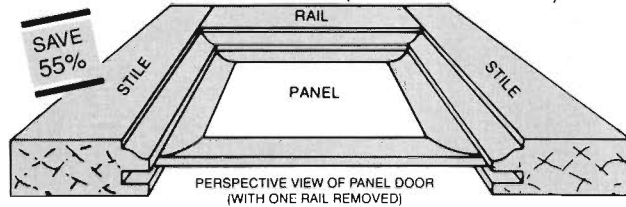
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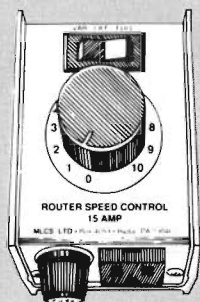
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#601	Solid Carbide	1/8" Spiral Cutter		1/8"	1/2"	1/4"	\$ 9.00
#603		1/4" Spiral Cutter		1/4"	3/4"	1/4"	\$12.00
#903		1/4" Spiral Cutter		1/4"	3/4"	1/2"	\$12.00
#904		3/8" Spiral Cutter		3/8"	1"	1/2"	\$24.00
#905		1/2" Spiral Cutter		1/2"	1 1/2"	1/2"	\$29.00
*Proper Adapter Will Be Supplied							
#530		3/16" Edge Beading	3/16" Dia. of Circle		1/2"	1/4"	\$15.00
#531		5/16" Edge Beading	5/16" Dia. of Circle		1/2"	1/4"	\$15.50
#350		1/8" Round Over	1/8" R	3/4"	3/8"	1/4"	\$11.00
#351		3/16" Round Over	3/16" R	7/8"	1/2"	1/4"	\$11.00
#230		1/4" Round Over	1/4" R	1"	1/2"	1/4"	\$12.00
#353		5/16" Round Over	5/16" R	1 1/8"	1/2"	1/4"	\$14.00
#209		3/8" Round Over	3/8" R	1 1/4"	5/8"	1/4"	\$15.00
#355		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/4"	\$17.00
#655		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/2"	\$17.00
#656		3/4" Round Over	3/4" R	2"	7/8"	1/2"	\$21.00
#199		Multiform Moulding	Unlimited Patterns	2 1/4"	2"	1/2"	\$40.00
#205		1/4" Cove	1/4" R	1"	1/2"	1/4"	\$12.00
#206		3/8" Cove	3/8" R	1 1/4"	9/16"	1/4"	\$13.00
#207		1/2" Cove	1/2" R	1 1/2"	5/8"	1/4"	\$14.00
#643		1/2" Cove	1/2" R	1 1/2"	5/8"	1/2"	\$15.00
#208		3/4" Cove	3/4" R	1 7/8"	3/4"	1/2"	\$26.00
#231		5/32" Roman Ogee	5/32" R	1 1/4"	1 5/32"	1/4"	\$16.00
#232		1/4" Roman Ogee	1/4" R	1 1/2"	3/4"	1/4"	\$17.00
#506		1/2" Pattern	Flush Trim	1/2"	1"	1/4"	\$15.00
#508		3/4" Pattern	Flush Trim	3/4"	1"	1/4"	\$17.00
#366		1/8" Slot Cutter	3/8" Deep	1 1/4"	1/8"	1/4"	\$14.00
#368		1/4" Slot Cutter	3/8" Deep	1 1/4"	1/4"	1/4"	\$14.00
#204		3/8" Rabbeting	3/8" Deep	1 1/4"	1/2"	1/4"	\$13.00
#670		3/8" Rabbeting	3/8" Deep	1 1/4"	1/2"	1/2"	\$14.00

ITEM NO.	BEST CUT BEST PRICE	DESCRIPTION	ANGLE/DEPTH/RADIUS CIRCLE DIAMETER	LARGE DIA.	CUTTING LENGTH	SHANK SIZE	PRICE
#211		3/8" Core Box	round nose	3/8"	3/8"	1/4"	\$10.00
#212		1/2" Core Box	round nose	1/2"	1 1/32"	1/4"	\$13.00
#418		3/4" Core Box	round nose	3/4"	5/8"	1/4"	\$15.00
#213		1" Core Box	round nose	1"	3/4"	1/2"	\$17.00
#548		Lockmitre		2"	7/8"	1/4"	\$32.00
#214		1/4" Straight	plunge cutting	1/4"	3/4"	1/4"	\$ 6.50
#216		3/8" Straight	plunge cutting	3/8"	1"	1/4"	\$ 6.50
#474		1/2" Straight	plunge cutting	1/2"	1"	1/4"	\$ 7.00
#219		3/4" Straight	plunge cutting	3/4"	1"	1/4"	\$ 9.50
#779		3/4" Straight	plunge cutting	3/4"	1 1/2"	1/2"	\$10.00
#462		1/2" Bull Nose	1/2" Dia. of Circle		3/4"	1/4"	\$16.00
#464		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/4"	\$21.00
#764		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/2"	\$21.00
#545		Tongue & Groove	Straight	1 5/8"	1"	1/4"	\$29.00
#845		Tongue & Groove	Straight	1 5/8"	1"	1/2"	\$29.00
#546		Tongue & Groove	Wedge	1 3/16"	1"	1/4"	\$29.00
#846		Tongue & Groove	Wedge	1 5/8"	1"	1/2"	\$29.00
#450		1/8" Beading	1/8" R	3/4"	3/8"	1/4"	\$11.00
#233		1/4" Beading	1/4" R	1"	1/2"	1/4"	\$13.00
#454		3/8" Beading	3/8" R	1 1/4"	5/8"	1/4"	\$15.50
#455		1/2" Beading	1/2" R	1 1/2"	3/4"	1/4"	\$17.00
#500		3/8" Flush	Trimming	3/8"	1/2"	1/4"	\$ 7.00
#501		3/8" Flush	Trimming	3/8"	1"	1/4"	\$ 7.50
#503		1/2" Flush	Trimming	1/2"	1"	1/4"	\$ 8.50
#221		1/2" Flush	Trimming	1/2"	1 1/16"	1/2"	\$ 8.00
#558		Thumbnail		1 3/16"	3/8"	1/4"	\$18.50
#858		Thumbnail		2 1/2"	3/4"	1/2"	\$35.00
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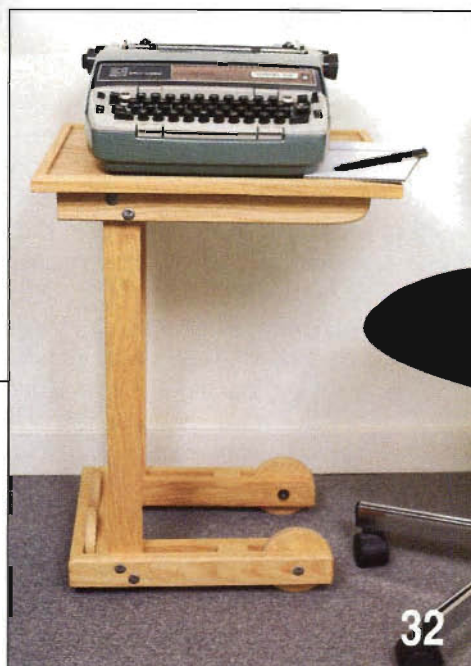
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On the Cover

Santa Fe, New Mexico furnituremaker Miguel Chavez is marking the locations of the corner blocks on his high-back side chair. Simple carved details and through-mortise and tenon construction define the Southwestern look of the piece. You can learn Miguel's techniques for mass-producing a set of these chairs in the article starting on page 37.



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Clear Cuts

The first time I ever had to draw project plans was in my second year of woodshop. Up until then, we had been told what to build and how to build it. Now, as eighth-graders, we could build what we wanted. This, of course, meant we would need plans. The instructor required us to prepare full-size drawings of what we wanted to build. He said, "If you can't draw it, you can't build it."

The workbenches in our school shop had vast, square tops of maple—a huge expanse where we would unroll long runners of butcher paper and climb about with our tape measures and framing squares, marking the hidden lines and joinery that would comprise our projects. Having an eight-foot by eight-foot drawing surface and endless rivers of wide, white butcher paper would sometimes lead us to dream big. I made plans for a cedar hope chest that was two feet wide, three feet deep and seven-and-a-half feet long. That big box would hold a lot of blankets. Fortunately, my shop teacher intervened before I started gluing up boards. He helped me scale it down to more traditional proportions.

Since then, I've come up with a few project plans without the help of my shop teacher, and most of the time I get the proportions right. In this issue, (shop teacher) Don Kinnaman shows a technique for creating accurately scaled plans using a catalog photo of the piece you want to build. It's a handy trick to know for those rare occasions when the plan you want isn't in *PW*.

Of course, we make every effort to see that the plans you want are in *PW*. In fact, while working on Don's article, we realized that the roll-top desk he referred to as he demonstrated his technique would be a popular project. So even though Don shows you how to make your own plans, we thought we'd work them up for you anyway. Associate Editor Rob Cook went all the way with the piece, making the plans and cutting lists and then building that big beauty in our shop. He's proud of the piece—as well he should be. If you decide to tackle this project, please send us photos of it when you get it done. You'll deserve to show it off.

David M. Camp

Be Safe!

Occasionally we show a setup or a technique that may appear to be unsafe. These procedures are demonstrated by experienced craftsmen who are comfortable using the setups they show.

It is up to you to determine whether or not you can safely perform these operations on your own equipment. There is always another way, and you should choose the method that seems safest to you.

Letters

We welcome your comments, pro or con, about articles we publish. Send your letters to: Editor, *Popular Woodworking*, 1320 Galaxy Way, Concord, CA 94520. Letters may be edited for publication.

Bud Vase Follow-Up

I enjoyed your article on turning bud vases (*PW* #64, January 1992).

Can you tell me where to get bud vase inserts of the right size ($\frac{3}{4}$ " X 3")? I've found some—but not the right size.

Paul E. Hyde
Corvallis, OR

The author replies: *The liners I use are chemistry lab test tubes. These are available in various size from chemical or laboratory supply houses and are reasonable in cost. If there is not a chemical supply house near you, go to your local high school or college chemistry lab, and ask for their source of supply.*

Devore O. Burch

A True Coffee Table

I liked very much your selection of Fred Caperton's plant table as winner of *Scrapwood Challenge* #1 (Issue #65, March 1992). I immediately made one and found Fred's instructions very good. The table looks nice and the project uses readily available scrap 2 X 4 lengths very nicely.

Only one problem: my plant table has a 26 oz. coffee can (Maxwell House) locked inside.

So much for high-tech, eh Fred?

Bob Swanberg
Chelsea, MI

Buckle Up for Safety

The article "Buckle Up In Style" by David Lepine (*PW* #66, May 1992) is certainly well written, and, I expect, a rewarding experience and even a money-maker at crafts fairs, but I shudder at his technique of sanding the back of the buckle with the belt sander. Two summers ago, I was trying to round down some small pieces of doweling to fit into a small diameter hole. I made a jig to hold my belt

sander as shown in the article, and I was holding the dowels with my fingers. Too much pressure or some distraction, and I very quickly ended up with a mangled tip on my right index finger. Had I placed that piece in a C-clamp or held it with pliers, I'd have a normal finger with full movement and feeling.

Our electric shop tools are very time-saving, but not very forgiving. Woodworkers should install a push-button phone in their shop just in case the tool does not forgive.

Walter Fehlman
Redding, CA

I have made buckles with the back flat. I sand the front to a curved shape, $\frac{3}{16}$ " thick on the ends, $\frac{5}{16}$ " thick in the center. I then use quick-setting epoxy glue to fasten the metal belt buckle hardware to the back of the buckle—being careful not to glue the ring to the wood.

Buckle hardware is available from Tandy Leather (Box 791 Fort Worth, TX 76101) in two sizes: #1601 for 1" to 1 $\frac{1}{4}$ " belts and #1602 for 1 $\frac{1}{2}$ " to 1 $\frac{3}{4}$ " belts.

James L. McDonough
St. Paul, MN

I enjoyed the article on wooden belt buckles. Perhaps Mr. Lepine and others can make use of this technique I learned years ago trying to fasten hinges to $\frac{3}{8}$ " or thinner material. I decided to use #10-32 machine screws. Simply use the appropriate (or close) tap drill, and screw the screws directly into the wood. It works fine and holds well.

J. Carlyle
Minneapolis, MN

Flag Etiquette as Pertaining to Scrap Plywood

When reading the *Scrap Solutions* in PW #66, I got a kick out of Sergeant Souza's Army Corps of Engineers Castle. I, too, have spent over twenty years in the military. When I looked at the castle, the first thing I noticed was that the flags were reversed.

The American flag is supposed to be placed on "the flags own right." That means that it should be on the right as you stand

in front of the building facing out—on the left if you are facing the building.

SFC Thomas J. Tomaski
Clancey, MT

Pressure Treated Health Hazards

In "Outdoor Furniture You Can Live With" (PW#66) you mention the toxicity of working with pressure treated lumber. In past years I have made numerous items from pressurized lumber—picnic tables, sand boxes, rose arbors, etc. Would you expand on the severity of the problem, and what we can use to protect ourselves from the effects of using pressurized lumber?

Glenn F. Markley
Mansfield, OH

The two most common dangerous preservatives are chromated copper arsenate and ammonium copper arsenate. The copper content makes the wood green. The lumber is saturated throughout when treated, so working with it will constantly expose more of the chemical. The dust can then enter the lungs or contaminate clothing and skin. Short-term exposure can irritate the throat, eyes and exposed skin; long-term, unprotected exposure can result in dermatitis, nerve damage, chronic bronchitis and even lung cancer in severe cases. There are also possible dangers to pregnant women and male fertility.

Efficient dust collection can be a life saver here, and this could be just the excuse you need for that new system you've been wanting (see Tool Talk on page 86). Also, OSHA recommends using a fitted respirator—those paper dust masks do not have any real seal and allow a lot in around the sides. They also recommend goggles to prevent irritation to sensitive eye membranes.

To avoid copper arsenates altogether, you can make your own rot-protected wood. Water repellents work well, and polyurethanes or epoxy sealers soak into the wood and slow decomposition even more. These products are also safer for use in vegetable planters where the arsenates could contaminate your food. If you really need to use pressure treated lum-

ber, be sure to take the proper precautions, and do a thorough clean up of both you and your shop afterwards.

Editor

No Myth

I just received your May issue and started looking through it. I got to page 7 and was really surprised at your answer to Alfred Clem under the heading "Where's Sears?"

I think you missed the point of Alfred's letter entirely, and showed some apparent bias in your answer.

I think almost everyone knows that Sears has no manufacturing capability. They are into marketing and service. Those of us that buy regularly from them recognize that service and parts availability more than make up the difference most of the time. I don't think any serious craftsman considers their guarantee a "myth."

I've found over the years that knowing who makes their products does not enable one to make a direct comparison; the Craftsman models usually have some important feature that distinguishes it from its competition.

I think that if you do a careful comparison of tools, such as *Consumer Reports* does, the ratings will be close—extending the value of Sears products in many cases.

Hought Wahl
Mahopac, NY

Until now, I have been a satisfied subscriber to your magazine, but your reply to the letter from Alfred B. Clem (Letters, PW #66) sounded like a real put-down to the Sears-Roebuck Co. and to those of us who choose to use Craftsman tools. Sears has marketed a lot of fine products over the years, and to a lot of us, the word Craftsman on their tools represents quality and integrity, and is much more than "just a label."

Myth? I don't think so. I believe most people realize that Sears doesn't manufacture everything in their stores. And I do think you are doing a disservice to your readers by not including an honest review of Craftsman tools in your magazine.

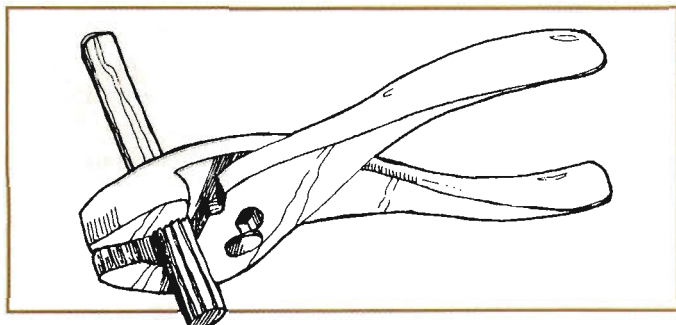
Dana Corey
New Concord, KY

Tricks of the Trade

Forming Glue Grooves

When using dowels to make or repair furniture, you need to make parallel grooves along them so the excess glue can escape. I've found that this is easily accomplished with the aid of a large pair of pliers. Take care to line up the grooves each time you pull the dowel through the toothed inner area of the pliers' jaws.

Howard E. Moody
Upper Jay, New York



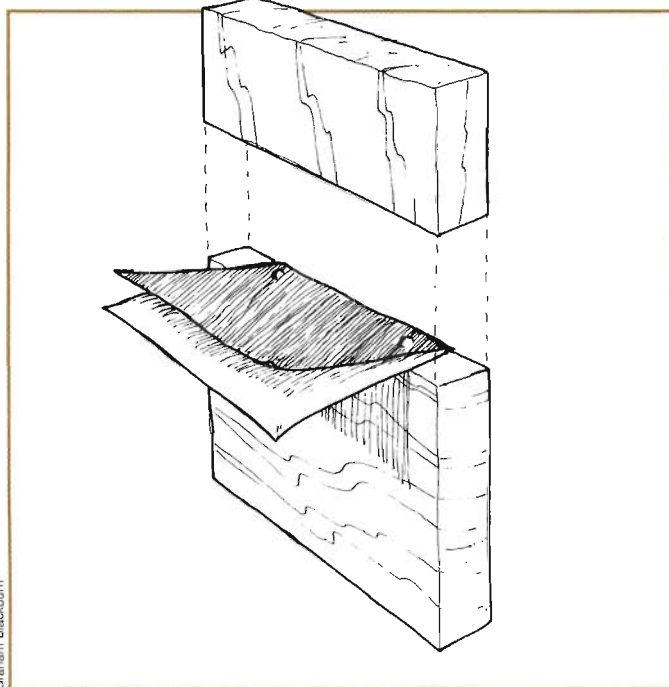
Vacuum Finder

Every now and then I drop a tiny screw or other small part on the workshop floor. Naturally, it bounces across the floor, under machines, and out of sight. Tiny items can be located and retrieved more easily if you place an old nylon stocking over the suction end of the vacuum cleaner hose. The suction will pull and hold the lost item against the nylon for easy recovery.

Howard E. Moody
Upper Jay, New York

Split-Shot Sinkers Locate Dowel Holes

It's easy to locate dowel holes with the help of carbon paper and small split-shot fish sinkers. Simply place the pieces to be doweled on a flat surface, fold a piece of carbon paper with the carbon side out, and place the split shot in the fold. Place the



Graham Blackburn

paper and shot between the pieces, tap lightly with a hammer, and both pieces will be marked in precisely corresponding spots. The light tap will cause the carbon to mark the work where the split shot touches, but nowhere else. Small pellets or BB shot will also serve in place of the split-shot sinkers.

Howard E. Moody
Upper Jay, New York

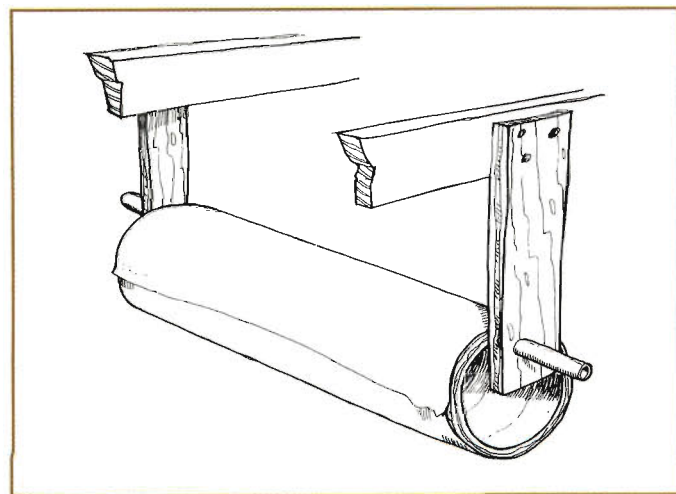
Making Tinted Wood Putty

Matching colors in wood with putty is a problem for all woodworkers. I use a little of the thick sludge in the bottom of an unmixed can of stain. Multiple colors can be combined to get just the shade for your needs. The sludge mixes well with solvent-based putties, and to keep it workable, just add a little lacquer thinner. It does take a little trial and error—you have to let the mixture dry before you'll know the final outcome.

David Lepine
Huntsville, Texas

Paper Roll End Has Many Uses

When I wanted to draw full-size patterns for a boat I was building, I visited a local plant that prints small magazines and obtained the discarded end of a roll of paper. These printers use 50-pound white offset paper that comes in enormous rolls about three feet wide. When they finish a print run and don't have enough left on the roll to finish the next job, the roll end is set aside for the paper recycler who pays \$15 to \$20 per ton. The printer should sell you a roll end for far less than that—and may even give you one for nothing. I cut a couple of plywood brackets to hold a



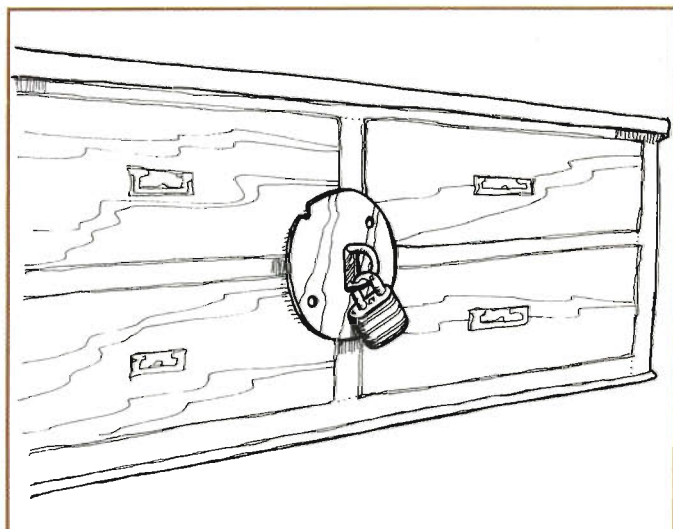
piece of $\frac{3}{4}$ " pipe and hung them from the rafters of my shop. Now the roll is always handy for sketching furniture designs, creating patterns, covering workbenches when I paint, or wrapping packages. Even the smallest roll is fairly heavy, so make the brackets sturdy. Fortunately, the smallest roll seems to last forever.

Kingsley Hammett
Santa Fe, New Mexico

Keep Out!

If you're having trouble with children or others getting into shop cabinets or drawers, consider padlocking them with this method. Screw in a heavy-duty hasp staple centered between two or four drawers or cabinet doors. Purchase the steel cover to a 4" round electrical box and cut a slot in it to fit over the hasp staple. The box cover should be large enough to lock the four corners securely. Insert the padlock and the lock-up job is done.

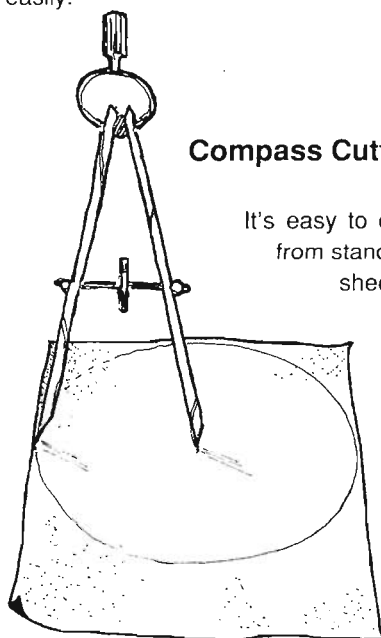
Don Kinnaman
Phoenix, Arizona



Drilling Steel

Sometimes I've had to drill a piece of steel so hard that the regular cutting oil I use does not prevent the drill from heating. I've found that by using turpentine as a lubricant, rather than the cutting oil, the drill keeps cool and the hole is drilled much more easily.

Howard E. Moody
Upper Jay, New York



Compass Cutter for Sanding Disks

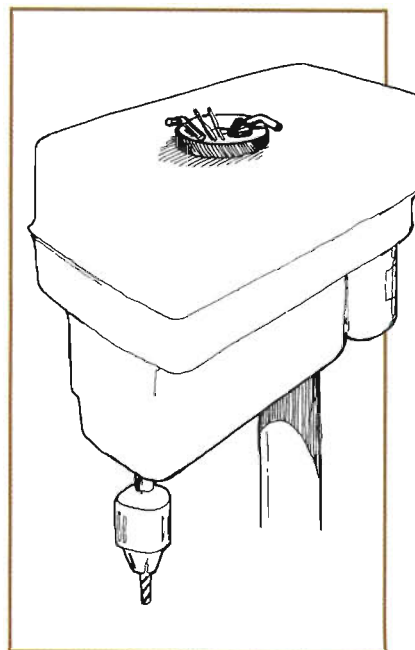
It's easy to cut circular sanding sheets from standard sheets with the aid of a sheet metal compass. Sharpen one leg of the compass to a knife-edge on the bench grinder. Use the compass in the normal manner. Disks can be cut quickly and accurately without dulling your good shears.

Howard E. Moody
Upper Jay, New York

Chuck Key Magnet

Have you ever misplaced your drill press chuck key, or worse yet, left it in the chuck when it's attached to a wire or chain? I put the magnet from an old radio speaker on the top of my drill press. Any small, fairly strong magnet will do. After a little practice, you'll find yourself returning the key to the magnet every time. I also keep a few small drill bits there, plus the Allen wrench used to swivel the drill on its mount.

James A. Johnson
Brunswick, Ohio



Removing Painted Screws

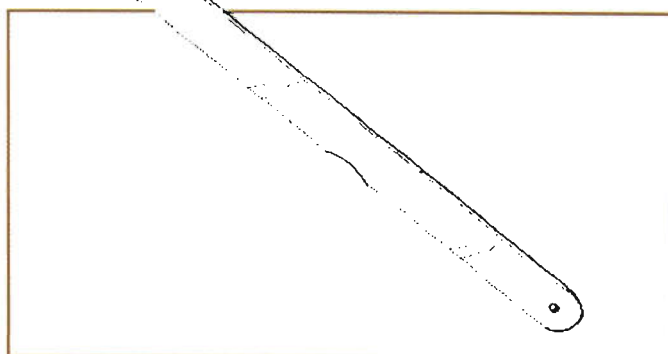
When you're removing wood screws from painted surfaces, the layers of paint or other finish have a tendency to glue-bond the screw to the material, making it virtually impossible to remove the screw without tearing up the slot. Try this trick—get a firm hold on the cleaned-out slot, and *tighten* rather than loosen the screw first. This action will break any bond with the finish, permitting the screws to come out with no problem.

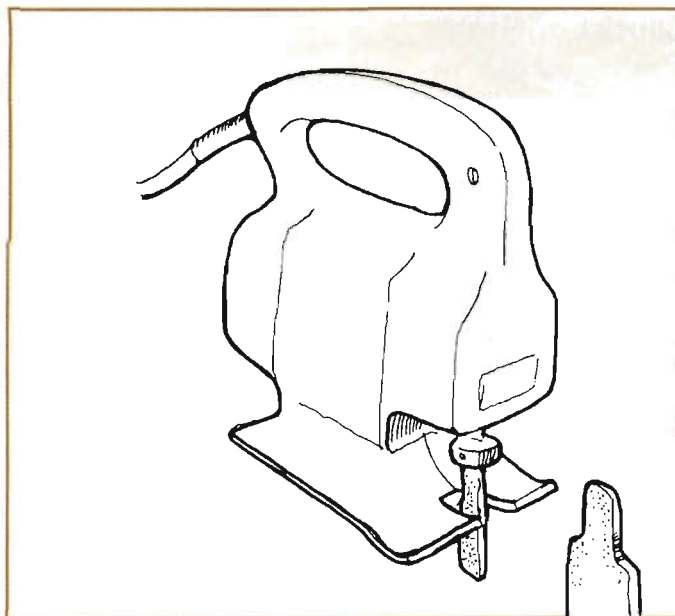
Don Kinnaman
Phoenix, Arizona

Pulling Teeth

If you've ever broken a few teeth out of your hacksaw while cutting a screw or bolt, you know what a job it is to make it continue to cut. The blade grabs and jumps and you end up putting in a new one. I've found that if you take it over to the grinder and cut out the break with a small radial cut, it will work as easily as when new, and save you the cost of a new blade or a trip to the hardware store.

Myron S. Levy
Gold Hill, Oregon

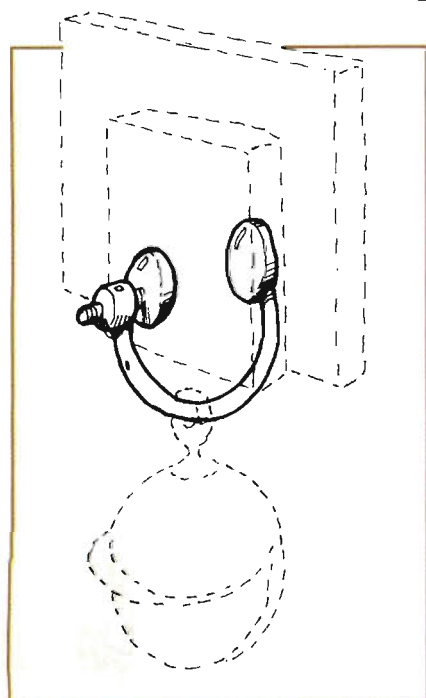




Sanding With The Jig Saw

If you have a scroll saw of the type that takes plain-ended blades, you can convert it to a sander. Cut some emery boards 5" long and trim the ends to fit your saw's blade holders. Now you can sand tight spots. If your saw takes only pinned blades, cut a narrow strip of sandpaper a little shorter than the blade, coat the back of the sandpaper with contact cement, and fold it around the blade. Clamp it until the glue sets and you have a sanding blade.

David F. Black, Jr.
Barnwell, South Carolina



C-Clamps From Jewelry

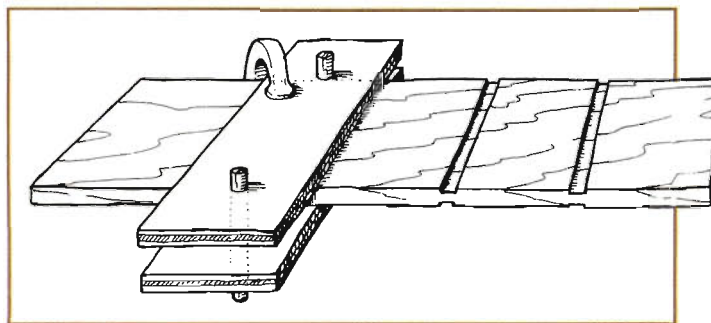
I've found that old discarded earrings with screw-type fasteners make wonderful little C-clamps for fine work. I've used these small clamps many times for soldering on jewelry and for other fine work. These clamps are also very useful when gluing tiny parts and for model work.

Howard E. Moody
Upper Jay, NY

Router Guide

I needed to rout a groove on both sides of a workpiece at several places along it. For visual appearance, the grooves on opposite sides had to be perfectly lined up with one another. I made a guide from two scrap pieces of plywood, each with a straight edge longer than the workpiece. Place one piece on top of the other, line up the straight edges, and clamp the pieces together. Then drill a hole through both at each end so they can be doweled together. Make the dowels long enough so you can separate the plywood pieces enough to slide the workpiece between them. Once positioned, the guide can be clamped in place, and produces a router fence to make identical cuts on both sides of the workpiece.

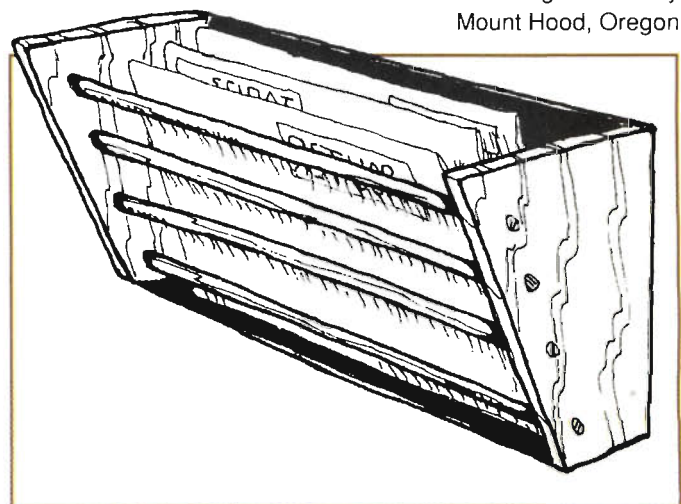
Dan Labzentis
Endicott, NY



Wall Rack For Instruction Booklets

Inevitably, no matter how familiar we are with our equipment, there comes a time when we have to refer to the manufacturer's instruction booklet. Finding it can be a problem. I made a wall rack from some scrap wood and dowels to hold 9" X 12" envelopes as shown here. Of course, the front could be a solid piece, but the dowels make it easier to get the dust out. The envelopes hold the booklets; on the back of each, with a large felt marker, I print the name of the equipment. Now it only takes a second to shuffle through them for the right one.

George W. Earley
Mount Hood, Oregon





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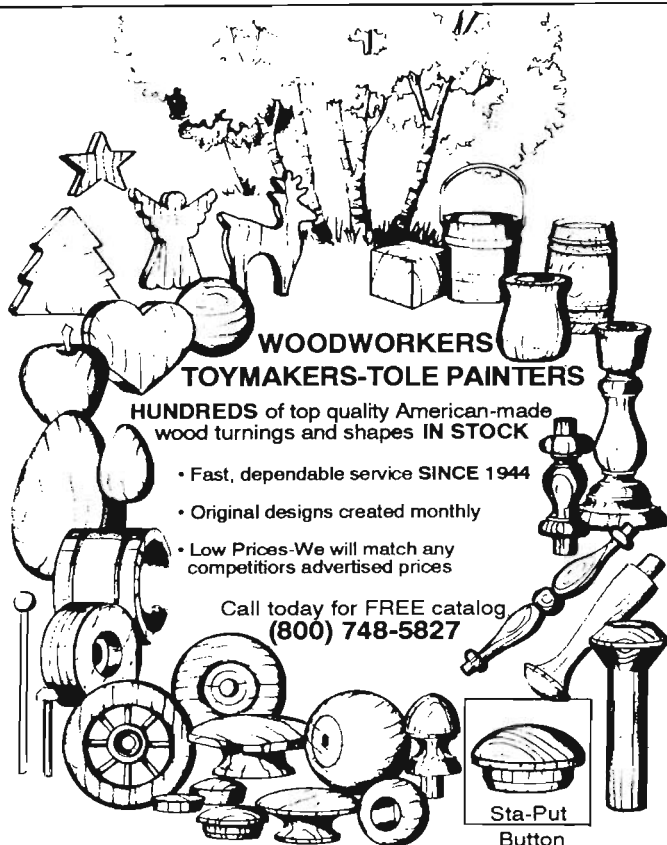
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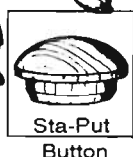
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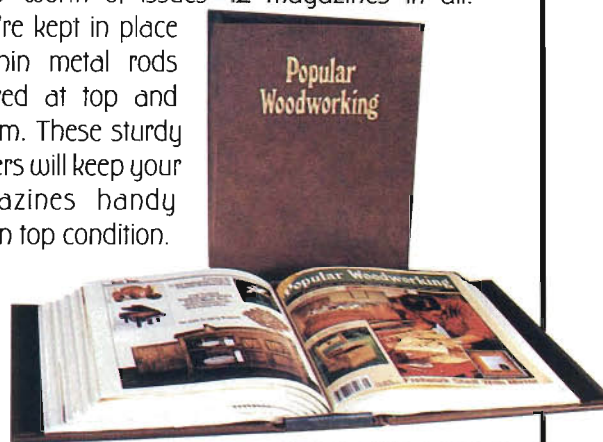


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High Time for Gloss

Being a novice woodworker, I'd like to know how to get a shiny finish on walnut—I know it has an open grain. I'm making a clock that's built in the shape of an anchor, and it looks like there will be a lot of end grain. Do I fill it; if so, with what? I've been told to use polyester resin as the final finish, is that OK?

John H. Cooper
Owosso, MI

I don't get much call these days for a high gloss finish but I'll certainly be glad to tell you how to achieve it.

Yes, it would be wise to use a filler on the wood first, one that's tinted to match the color of your walnut clock. I suggest Behlen's Pore-o-Pac Paste Wood Filler. It will fill the pores, and give a better foundation for whatever finish you use, though on irregular surfaces it may be hard to get the filler to take.

Start with a wash coat of shellac as a sealer. Follow up by laying on two or three coats of polyurethane with a soft brush, or you can apply the coats deftly with a piece of cotton T-shirt. This eliminates runs, but leaves you with less build-up.

Don't expect the polyurethane to magically give you a hand-rubbed, glossy surface. You'll have to create that with elbow-grease. After the varnish has cured for a week, rub it out with

a pad of #0000 steel wool lubricated with mineral oil. Be careful not to rub through the edges. Afterward, saturate a soft cloth with mineral oil, and sprinkle it with rottenstone abrasive powder. Check your progress by cleaning the oil from a small area to check how you're doing. Continue this process until you're satisfied.

Remove all traces of oil and rottenstone from your clock; then finish up with a coat of paste wax. A wax tinted with pigment, such as Liberons Georgian Mahogany, will bring your project to perfection

Tom Wisshack

One Of The Flock

I intend to produce a line of jewelry boxes and other similar products, and it seems to me that there must be a method of spraying flocking on a wetted, glued surface without getting any on the areas where it's not wanted.

Howard K. Gaston
Naples, Florida

As a teenager, I was heavily into building model cars. I used to customize the interiors by applying flocking to the seats in imitation of velvet or mohair. The stuff came in clear plastic tubes, you squeezed the tube and the material sprayed out from a small hole on top onto the pre-glued surface. I believe that particular product, at the time, was called "Funny Fur". Does anyone remember?

I contacted six different hobby, art and craft supply stores and none of them currently stock such a product. I remember looking through an art supply catalog a few years back, and coming across the flocking in various colors (sold in bulk) and a special spray gun for applying the adhesive. So, it's quite possible the stuff is still being made somewhere. A wholesale craft supply house might be your best bet. (Suede-Tex, two color kit, \$59.95, from Woodworker's Supply Inc., 800-645-9292 Ed.)

As to application: Mask off the areas you don't want to flock and use a light-tack masking tape so you don't damage the finished wood. For odd-shaped areas, try a liquid rubber mask like the type sold by pottery supply stores. I recommend white

glue for the adhesive. It's easy to clean up and moderately strong, which, in this case, is all you need.

Tom Wisshack

One Coat Color

I build a lot of craft items out of wood and I have a problem painting them. I use latex or acrylic paint for most of my items, but sometimes I use oil. As a rule, I give the wood a white undercoat because a lot of my projects have white in them. But then, I've been having to use three coats of colored paint over the white to get a good solid covering. Recently, I discovered Liquitex. It comes in 2 oz. bottles and has the consistency of whipped cream. It does cover in one coat but costs four times as much as other 2 oz. bottles. Are there any other types of opaque paint available that aren't so expensive, yet cover in only one coat. I'm a good house painter, but these small objects give me problems.

Russell "Gramps" Fisher

With the exception of semi-transparent or "candy" colored automotive paint, all pigmented paints are more or less opaque. As you've experienced, the opaqueness, or hiding ability varies from color to color and by manufacturer.

One way to eliminate the expense of buying small quantities of artists paints is to have your local paint dealer color match your samples. This way you can also select semi-gloss, flat or eggshell and then finish with a top-coat of varnish.

One problem you may encounter when having colors matched is that the paint dealer can only add so much pigment without inhibiting the paint drying process. This is particularly true with darker colors, but more than likely, he'll be able to match the shades you want. You'll save money, and I believe this type of paint is more durable than artists pigments since it's designed for woodwork.

If you use a latex primer, I suggest that you first give your project a wash coat of white shellac. This prevents the water in the latex from raising the grain of the wood and leads to a smoother final product. An oil based primer also solves this problem.

Tom Wisshack

Tom Wisshack makes and restores fine furniture in Galesburg, Illinois.

Dick Fitch is the resident alchemist at The Bartley Collection, Ltd.

Problem Spots

I'm using a gel-type, solvent-based stain and varnish on a project that I'm building. I have carefully prepared my wood, and I use rubber gloves when I rub on the stain. My problem is, when I apply a second coat of stain or even the clear finish, the color comes off the wood in splotches. Actually it looks like leprosy, it just won't accept the color. I sanded it down, and it did it again. Help.

Chip Howard
Seal Beach, CA

The staining problem you describe is probably caused by the synthetic plastic gloves you wear while staining and handling furniture in process. When the furniture, or a component is handled with gloved hands, a contaminant is often deposited on the surface, especially by the pressure of finger tips. This deposit acts like a plasticizer or inhibitor that prevents the stain from drying. Subsequent coats of stain usually do not indicate the problem because the whole surface remains a strong dark color. When varnish is applied to the stained surface—especially if it is rubbed on with a cloth—the stain comes off the spots or areas that have not dried. Result: an unsightly appearance and a disheartened wood-finisher. The solution is unpleasant but successful: sand the surface back to clean wood and stain it again.

Sanding is the preferred way to remove an unacceptable gel finish. Gel finishes do not penetrate far into the surface, so they're relatively easy to sand off. Removing the finish with solvents may carry the contaminant into the wood, instead of completely removing it.

When you re-stain, be sure a clean cloth is over your gloved hand whenever a piece is handled. If the spots appear on pieces that can be isolated, tape off the contaminated board and sand and refinish only that area. The taping and refinishing should be done on the whole length of the board. It is virtually impossible to successfully tape across the grain and finish a partial length. When you tape in this fashion, be sure to remove the tape immediately after staining and wipe the tape

line into the stained area.

Gel stains are usually supplied with much higher binder levels than penetrating types, so good positive drying is important. Because these products are wiped on with a cloth and often rubbed or buffed, each coat is subject to considerable attrition. In spite of these considerations, gel stains have many advantages that make the extra time and care well worth it.

Plastic gloves are not the only source of surface imperfections encountered in the staining process. Oil, grease, wax, water, spots, erratic sanding and a whole host of other things can cause problems. Fortunately, they usually do not.

Dick Fitch

Old Kitchen Cabinets

A number of years ago I installed new kitchen cabinets and finished them with a polyurethane varnish. They're starting to look worn and I'm wondering how I might best restore the finish. Do I have to strip and re-varnish them or can I save the existing finish?

Roger Nelson

If the wear you mention hasn't penetrated to the wood, you can re-coat your cabinets. First, scuff the surfaces with 320-grit wet or dry sandpaper; then apply, if possible, the same brand of varnish you used the last time. Thin the first coat to ensure a good bond to the old varnish. Subsequent coats, two more would be ideal, can be applied full strength. Lay as much of the cabinets down flat as you can—at least remove the doors. This lessens the chance for runs.

If the wear is too excessive, you'll have to strip the old varnish completely off the wood. With the pieces horizontal, apply a heavy coat of stripper—I suggest Strypeeze Brand by Savogran, Norwood, MA 02062. Cover the coated surfaces with a sheet of waxed paper; and when the finish has softened, scrub the pieces with alcohol and steel wool to remove the residue.

A couple of heavy coats of varnish will last for many years.

Tom Wisshack

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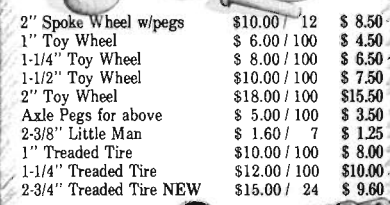
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Doormaking Patterns and Ideas by John Birchard (Sterling Publishing Co., Inc., 387 Park Avenue South, New York, NY 10016-8810) 200 oversize pages, paperback, \$18.95

Today's commercial raised panel doors are far less attractive than any of the fifty or so doors presented in this book. Many of the doors are presented in color photos and the requisite drawings are supplemented with intelligent text and suggestions for further modification and enhancement.

This is easily the finest door book I've encountered. The last door book I read suggested, between the lines only, that door making was a great mystery, and I left that volume just as mystified as I entered it. Birchard's book is different—his enthusiasm rubs off on his reader easily. If his intelligence rubs off as well, I'll have a nifty new back door pretty soon—goodness knows, my house could use one!

Chip Carving Patterns by Wayne Barton (Sterling Publishing Co., Inc. 387 Park Avenue South, New York, NY 10016-8810) 127 pages, paperback, \$9.95

Hugh Foster is an English-teaching woodworker in Manitowoc, Wisconsin, and the author of The Biscuit Joiner Handbook (Sterling Publishing, 387 Park Ave South, New York, NY 10016).

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Unless it's expertly done, a little chip carving can go a long way. Barton is one of the world's great chip carving experts and his book shows how projects can be embellished tastefully. In some cases, the carving is integral to the design and not embellishment at all.

Each line-drawn pattern is accompanied by a photo which illustrates the design principle being taught. Carved letters have always struck me as being particularly beautiful, and this book presents two alphabets for carvers that are so delightful that I'd be pleased to have them as fonts in my laser printer. One does not need to be a chip carver to get good value from this instructive text.

The Woodwright's Eclectic Workshop by Roy Underhill (The University of North Carolina Press, P.O. Box 2288, Chapel Hill, NC 27515-2288) 238 pages, hardcover, \$24.95, paperback, \$15.95

Roy Underhill's television program is one of the most entertaining and useful of the several woodworking programs on PBS. While most of us aren't likely to try many of his projects, it's indeed refreshing to have someone with a good sense of humor show us how things used to be built. Part of what makes the show and the books so interesting is that Underhill has access to first-rate craftspeople of all varieties at colonial Williamsburg. His book reflects this variety with projects ranging from whirligigs to log cabins.

Underhill's book contains four excellent chapters on machinery, furniture, amusements and musical instruments. Projects include a rocking horse, kayak, four-harness loom, toboggan, dulcimers, flutes, collapsing ladder, treadle lathe, gunstocks, plus several kinds of chairs and tables.

Turners will be amused by the "ring of beasts" toy where individual beasts are cut from a ring of turned wood with a saw. Several of these colonial toys strike me as being more fun to build and play with than the contemporary child's fare.

Even if you're not interested in the projects, Underhill's observations about woodworking and about human nature make his book well worth reading.

Learning to Use Your Scroll Saw: A Step-by-Step, Project-by-Project Manual taken from Joanne's own All Day Hands-On Seminar: 23 Projects with Full-Size Patterns by Joanne Lockwood (Woodworker's Supply of New Mexico, 5604 Alameda Place NE, Albuquerque, NM 87113) 55 pages, oversize paperback, \$10.95

Without treating the reader like an imbecile, Lockwood takes us from the absolute beginning through nearly two dozen small, fairly quick projects. Besides the cost of the book, readers are out only a few dollars for practice materials.

In the first 18 pages Lockwood presents introductory material that will have the reader ready to use the saw for projects like the child's jigsaw puzzle. The photos and drawings which accompany the text are first class.

When I first put my hands on a scroll saw, I did so without any previous instruction. Whatever scroll saw skills I now possess are the result of trial and error. The owner's manual was worse than useless, and there were no clear instruction manuals available. Were I a manufacturer of scroll saws, I'd want to license this book so I could ship it with every saw I sold.

Make it Accurate Once or Thousands of Times by Orin L. Buchleiter (Woodworker's Supply of New Mexico 5604 Alameda Place NE, Albuquerque, NM 87113) 41 pages, oversize paperback, \$12.00

If you value accuracy as you pursue woodworking, you should probably read this book. The author was a "goof-proofer" for high-tech tooling and the topic of this book is jigs and fixtures. Book and magazine articles often suggest using a jig but sometimes fail to explain the theory behind it. Buchleiter does not tell us about specific jigs, but about the characteristics effective jigs have in common.

After an introduction to materials and methods, he lays out a pair of projects which help the reader to understand the logic behind making jigs. I find myself glad this is a short book—I'll be reading it many times to gain all it has to offer. **[PW]**

Dennis White shares his woodturning knowledge with us in a set of six video tapes. We reviewed the first three tapes in issue #65. Parts 4, 5, and 6 assume you've seen the first three tapes and that you're an accomplished woodturner.

The series is produced and copyrighted by Knowhow Productions Limited, P.O. Box 43, Greenford, Middlesex, UB6 8TX, England. Available in the United States from House of Woodturning, RFD 3, Box 242, Putney, VT 05346, (802) 387-4337.

Part 4: Novelties and Projects ©1988, \$39.95 plus shipping, 100 minutes.

The projects on this tape are a ring-shaped base for a glass dish, a housing for a clock mechanism, a napkin ring, a wooden egg, a pen, a lace bobbin, an auctioneer's gavel and a coffee grinder. Even if you're not interested in creating one of these projects, the new techniques White demonstrates are worth the watch.

The majority of these projects involve the careful fitting of various objects into a turned recess. White makes extensive use of these recesses and plugs turned from scrap to hold parts for further refinement or finishing. He frequently makes use of dividers to transfer measurements to the spinning workpiece, and relies heavily on a very short skew chisel with a long handle. He demonstrates the skew chisel with a view of his hand position next to a close-up inset of the tool edge—helping you to better understand the workings of the tool.

White demonstrates one of his original techniques on the auctioneer's gavel project. Instead of using a drill press to bore the hole for the turned handle, he turns a recess in a scrap piece of wood just the right size to accommodate the head crossways. He gauges with a pencil point on the tool rest, then delicately adjusts the head until its axis is exactly at right angles to the lathe. The gavel head is then bored with a bit mounted in the tailstock. Finally he turns the handle to fit the hole.

Part 5: Classic Profiles ©1989, \$39.95 plus shipping, 107 minutes.

Alan Marks designs and builds furniture in Carmel Valley, California.

The title of this video does not reveal much about its content and purpose. The projects all involve turning between centers with exercises in judging proportion, form, spacing and shape. The projects for this lesson are a Georgian pattern leg and newel post, Victorian and Regency balusters and a lamp base.

To help the viewer understand the overall procedure for each project, they're first previewed in fast motion. A profile of the completed object is projected on the rotating cylinder. As White removes material from the workpiece, you see the process and sequence needed to reach the shape.

The narrator refrains almost entirely from commentary. You're left to interpret things on your own. I think the presentation would have been more effective if a description had accompanied the process as it unfolded.

Measured drawings of these classic profiles do not accompany the tape. If you wanted to reproduce them, you'll need to undertake substantial research and measurement. Still, there is a lot to learn from this tape that can't be learned from a book.

Part 6: Twists and Advanced Turning ©1989, \$37.95 plus shipping, 87 minutes.

The final tape in the series deals with a topic which has always intrigued me—the twist. Those who want to incorporate twists into their work will need this tape in their library. I was surprised to discover that the lathe is an indispensable tool in laying out and roughing the twist. I always assumed that twists were carved laboriously by hand.

The five versions White shows us are the single twist, the double or barley sugar twist, the ribbon twist, the tapered twist, and the hollow twist. He explains how to determine the pitch and draw the appropriate guidelines for turning each twist on the lathe. He uses a back saw to cut along the valley spirals, rotating the workpiece constantly and cutting to a depth of 1/2". The kerf helps in clearing out waste when the workpiece is rotated by hand against a gouge held on the tool rest. He then moves the gouge to follow the spiral. The twist is successively gouged and palm-planed until enough wood has been removed for a rough sanding. The first sanding takes

place with a hand-held, curved block as White hand-rotates the workpiece. For finish sanding, he runs the lathe at a slow speed and sands the twist with a piece of fine sandpaper held between thumb and forefinger.

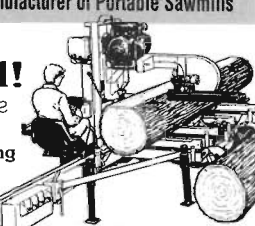
Here again, Dennis White's video is the only instructional tape available which demonstrates this type of decorative work. **PW**

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A Pattern for Success

Michael Elkan's story might matter to you. With a few hand tools and no woodworking experience, he started a small shop which, in the space of thirteen years, has grown into an international business with nearly a half-million dollars in annual sales. His experience presents a pattern which might help to guide you in building your woodworking business.

Having grown up in the clothing business in Philadelphia, Elkan by age 25 was a well-respected designer. But when life in the fast lane became too hectic, Michael and his wife Sharon headed west in search of a different life. They found it in a forest clearing in the foothills of the Cascades 50 miles from Portland, Oregon—fifteen acres bordering a mountain stream with a solid, serviceable house. Their first years were spent remodeling, building a shop, and adapting to life in the slow lane. The shop has grown over the years, with an addition tacked on here and another there, so that it's really a series of rooms, none very large, where today ten people create the company's product. Scattered around the clearing are several large sheds bulging with wood. The atmosphere is friendly and easygoing.

Michael and I sat in his office at the back of the house and talked. His answers to my questions tell the story better than I can.

How did you get started as a woodworker?

It started as a kind of a lark. I'd been living out here for about five years doing odd jobs like tree planting and helping farmers. I was pretty much living the life of a hippie. After having split shakes and put a new roof on the house and built a log cabin, sauna and a fireplace, I was just beginning to learn how to use my hands. In the East I'd never used my hands for anything—it was always designing or selling, a different kind of mentality. Now I found myself trying to deal with wood, so I went to auctions,

bought hand woodworking tools and started working with wood. I found burls and thought they were real interesting and started to play with them.

A friend, who was a blacksmith, talked me into buying a band saw. That opened up the whole woodworking field. The tool was right for me. It lends itself to a kind of free thinking—going to the band saw and just cutting something. It's not like a table saw which hasn't much flexibility. With the band saw you can just start cutting and let your imagination flow and cut shapes you like, and that's the way it all developed.

How did you get started in business?

I started to work on chairs because I needed one in the house. I read a few books, saw the basics of chairmaking and started doing it. Then I played around turning things and making bandsawn boxes. My blacksmith friend had been showing his work at the Craft Courtyard at the state fair. He saw some of my



author





things and said I should show them at the Craft Courtyard, but I'd have to demonstrate my work there, too. I said I don't know anything, how can I demonstrate when I don't know what I'm doing? Well, he said just go, the stuff looks good and it'll be okay.

So I got together with Sharon and my brother Charles and we started to make things—boxes, turned vases and a chair, and a couple of coffee tables, and we went to the state fair. We hauled our band saw over in the back of the pickup and set it up and our stuff was an immediate success. We sold out everything we had in two days, everything it had taken us the whole summer to make. We had no skills, we were sanding everything by hand and cutting with carpenter saws—we knew nothing about what we were doing. It was all experimenting so it took a long time to get that first batch of work together. Well, after we'd sold everything in the first two days we had to learn how to make them or else we'd have nothing to sell, so we taught ourselves during the ten days

we were at the fair how to make the boxes. Every day we'd go and cut more burl and sand and glue and rub the oil finish on and put them out for sale.

When did furniture come into the picture?

From the beginning—we sold our first piece of furniture at that show. I was working on a rocking chair then which was kind of my version of mission style. As it happened, the piece was a combination of black walnut and maple burl. I'd used maple burl slats and arms, and it was the first piece where I used that combination, the same woods that I use today. So right from the beginning we sold boxes and furniture.

What was your design philosophy?

I don't know that I thought about it much. I think, if there is one, it's to try and show the beauty of the wood. You try to show it in the simplest way you can and let the wood do the talking—but always your own complexities become part of the pieces you're producing, so you may say that you want to do something that is the ultimate in simplicity and just a beautiful presentation of this wood, but then there's you that becomes involved in it and we are not always as simple and calm as we would like to be. That comes out in the piece, too.

Did that philosophy develop as you evolved your style?

I have never been what I would call a consummate woodworker. I've never been interested in doing fine joinery, making joints, or in the techniques that are the real focus of fine woodworking. The piece has to have a certain simplicity because I don't want to do fancy trick dovetails or joints that take forever, it isn't my way. So the philosophy didn't

change much; it has to be something that goes together and stands up by itself, a nice tight piece, constructed sensibly, strong but not necessarily with a lot of interesting joinery.

Where do you get your wood?

When we started, we mainly used maple burl which was considered trash wood. There was maple burl all over the Northwest that nobody was using. That was always a forte of mine—find something that nobody uses and try to make something. It all fit into the way I was thinking. Now there're more people using it, but it's still not a major marketable kind of wood. When you're in the woods cutting fir, there's always a certain number of maple trees and burls, although some say it's one tree in a thousand that has a burl. They're still out there, and there are people who get contracts to go out and get them. We've worked with a number over the years and that's the way we get the wood.

You use other wood beside burls—where do you get it?

The Business End

Usually from lumber brokers. The walnut is all local wood. Somebody has a walnut tree on their property they want removed, so they cut it down and we buy the log from them. There's no walnut forest so it's just the odd tree that you get.

You have to spend quite a bit of time searching for wood?

It's one of the things we do, it's definitely one of the things we do. People come to us because they know we use these kinds of wood. We get calls from people who have logs and we follow up a certain number of these leads.

Do you air dry it and if so, for how long?

Yes, and it depends—for furniture wood the average is about three years. On box wood the average is about six months.

Then you put it in the kiln, or doesn't the furniture wood go in the kiln?

On chairs we use the natural shrinking as the wood dries to lock the legs and spindles. It's the old Windsor chair technique. As far as tables go, if it's wood that's air dried over three years we don't kiln dry it. If it's for cabinet work we do. In cabinets, even though we try to simplify the joints, it's better to have the moisture down to 7% or 8% when we start.

How long did you and your wife work alone?

Not very long. We hired people to work with us by the end of the first year. In the first year we contacted ten to twelve galleries and started selling to them. Today we're still selling to almost all of them and they're some of the finest galleries in the country.

How many people do you have working for you, and have you had trouble finding people you felt were good enough to produce your pieces?

We have about ten. We never really thought about hiring people as craftsmen—we looked more at their personality. We want people

that we think are good people, who we can relate to, who we can be with every day.

Do you have to train them?

It's kind of an evolutionary training. They have to learn first how we use the wood. Usually when they start they just sand. We notice the attention they give to the wood. We show them how we put the pieces together and how we match them up. We build them up gradually that way. It doesn't take long when you're involved in the shop atmosphere to see what we're doing and how we're doing it. It's not a matter of technical expertise; it's more a matter of doing the right thing, seeing how we think about the wood, and fitting into that kind of work.

Have you always sold through galleries? How do you set prices?

Yes, we've always sold through galleries. Prices weren't and still aren't defined the way industry would do it. Using the kind of material we use, there's no way to go in and analyze every cost. It's impossible to define this kind of wood. It's not like you're dealing with a board foot of stock and making a product out of it. You're buying a glob of wood and trying to make something from it. So we sort of winged the whole concept of pricing.

Let me tell you what I did and see if it fits your thinking. I priced my work at the highest price I thought I could get at the time. And as I built my backlog I raised my prices.

There's a certain truth to that, but if the product didn't sell at that



price I lowered it. The way I feel about it is anything you make is saleable. I did what you said and my perception of what the highest price should be has changed over the course of thirteen years. I feel that the price a piece sells at is a fair price. If it's worth \$100 it will sell at \$100. If it's worth \$1000 it will sell at \$1000, and if it's worth \$10,000 it will probably sell at that. So the prices kind of evolved and the windup is that it all averages out, you make a living, and you can make a really good living, but you never gouge anybody. It works out. On some pieces you lose and on some pieces you get extra.

How long did it take you to start making a living from your work?

We made a living the second year. We didn't make a lot of money but it was enough to live on and we scraped by. By the end of the second year we'd developed a clientele both retail and wholesale and it went right on from there. I think a lot of that was because we were putting something a little different on the market, it was priced fairly, we were able to wholesale it and make money, and the galleries were able to sell it and make their margin.

Do you enter many shows?

As a company we do four or five craft shows a year. We do the American Craft Council shows, two of them generally—Baltimore and Springfield, Massachusetts. They're the two biggest craft shows, very high-quality juried shows that have wholesale and retail parts. The first couple of days is wholesale and the last couple retail. They get the collectors there to buy major works and they get the major galleries from all over the world. So we've stuck with the American Craft Council all the way through. Then we do some other very high-caliber shows like the Philadelphia Craft Show which is one of the best in the country, and the Evanston, Illinois Show and sometimes the Coconut Grove Show. It all depends



on where we get accepted and which ones we decide to enter.

How do you sell your products today?

The same way—we get a very big percentage of our wholesale or gallery orders at the American Craft Council shows. Then we do a couple of other retail shows where we test a lot of new things and we also have something that the public and the collectors can buy. So the way we market has stayed pretty much the same. Now there's a lot of word of mouth, with the galleries coming to us. We do have a certain amount of retail that we get directly. It starts at the shows where people take pieces, we develop a relationship with them, and they order additional pieces direct.

Since most of your work goes through galleries, what percent do they take?

We sell wholesale, we don't do consignment. The galleries will generally double the price they pay although now the margin in some galleries, because of higher costs, is going up from 50% to 55%.

You don't sell anything through distributors or reps?

No. We've always found that we're the only ones that can really sell our product.

What are your present gross annual sales?

A ballpark figure would be around a half-million dollars.

How do you ship?

We ship furniture by truck. We take it up to Portland and have it crated. Sometimes we ship blanket wrap, up and down the West Coast.



The Business End

Blanket wrap means in a moving van—doesn't that get pretty expensive?

No, it's the most economical way. You can ship all up and down the West Coast for a very small amount. There's no minimum. It's because it's not a moving company, it's a blanket wrap company. Sometimes I have it crated or cartoned and ship by air. For some of the items, like the rocker and the dining room chairs, I went to a company in Portland that makes cartons and had their designers develop a carton to fit my chairs. Now we can ship them safely by air anywhere in the country.

You're shipping to galleries?

Sometimes with furniture we ship direct. We often take orders at the shows and then ship direct to the people.

How does a typical day go for you?

A typical day is to go out to the shop and check on what everyone is doing, check the mail, and then work some on the saw to develop a few things.

And in the beginning, what was it like?

It was a lot different—a lot of night work and every weekend and pretty much every day. Even today I work some every day, because the shop is here and I enjoy it. I go out to the shop seven days a week. I may only do some drawing on the boxes or a bit of cutting, but I'll be involved in it every day. In the beginning, setting it up was a lot of hard work, and if you want the business to be successful, it's a lot of hard work all the time. I have my brother with me who handles most of the business aspects. He

handles all the books and talks to a lot of the customers every day so I don't have to do it. My work can be more in line with research and development, the more creative things that I would rather do.

Would you like to add anything more?

One measure of success is the people who collect your work. That's really gratifying. A lot of the letters I get are from people who buy my work. Some call me up or see me at the shows year after year and tell me that they still enjoy my rocking chair or have boxes that they still enjoy and have them on display in their home. That's always a nice thing to hear; it's a nice hit that you get knowing that things you made people appreciate. Some of my collectors are well known and that, egowise, is nice. Then again, others are just regular people and that's really nice, too. I get an equal hit from knowing that George Bush or Carly Simon has a box as well as some guy who's just a postman, or whatever, who comes by and says, "you know I saved up my money and I bought one of your rocking chairs and it's just fabulous, I love having it". That's a nice part of the business, you meet some great people.

One of the reasons to have your own woodworking business is to do it on your own terms. This kind of small business is one of the few things that affords you the opportunity to do that. You don't have to have a goal to do as much work as we do—the goal might be to work four days a week and do something you enjoy and make a decent living out of it. You set your goal to earn enough to live the life you want to live and you aren't pushed by the idea that you've got to build this business into a tremendous

thing, you've got to drive yourself to make this thing into a real big affair. You say to yourself, I want to live a certain way and as soon as I've gotten to that point, I'm satisfied. That's the beauty of it. If there's one goal to being in business for yourself, it's to be your own man. That doesn't mean it's 100% your way. You make compromises along the line to make things work. It's not that self-centered a world—you have to deal with other people. You're not necessarily compromising in the sense that you have to compromise your ideals or your principles. It's more like harmonizing with people because you have to do that one way or the other. You're not going to find yourself in a void; you have to deal with other people.

I've called this story "A Pattern for Success," and the pattern is there for anyone to follow. You don't have to be an experienced woodworker and you don't have to live in a big city, nor do you need a lot of money or a fancy shop with a lot of expensive machinery. What you do need is the confidence that you can do it, the determination to do it, and the enthusiasm for it that will keep you going until you succeed—like Michael Elkan.

PW



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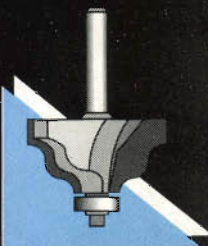
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The Jack Plane Defined

A reader recently sent in a photograph of an unusual wooden plane with a request for information. He'd found this tool in the Southwest. It appeared to be about 18" long, with a fairly low-angle blade of square profile set in a standard mouth. Apart from the rather shallow angle at which the blade was seated, these features weren't too remarkable. What stood out was a pair of large transverse handles, one at the front and one at the back, mounted on the top of the stock. Closer inspection revealed something else unusual: the cutting iron assembly was stamped with a series of unusual marks and foreign words.

The tool would have aroused little interest a generation or two ago, since it would have seemed similar to many others in shops and toolkits everywhere. Indeed, its salient features—the wood it was made from, its length, general shape, the blade profile—were common to a host of everyday tools. Even the wedge-shaped blade was typical of—if not standard for—most plane blades made then. A woodworker more intimate with planes might have remarked on the transverse handles, and perhaps noticed the foreign origin of the blade, but even so, the tool would probably have been regarded with little curiosity.

Progress marches on, and with it, tool design. A form that was recognizable for several hundred years is now an unusual oddity. Much that we've discarded, however, is still valid, and is sometimes still the better way to go. The common wooden jack plane is a good example.

Simple Tools, Sophisticated Results

For a very long time all that you needed was a handsaw, a plane or two, and various other small, inexpensive handtools. Today many assume that woodworking, even as a hobby, requires a sizeable outlay—table saw, electric router, as many expensive power tools as possible. This

Graham Blackburn is a furnituremaker, writer and editor in Rio del Mar, California. His many books include The Illustrated Book of Housebuilding and Carpentry.

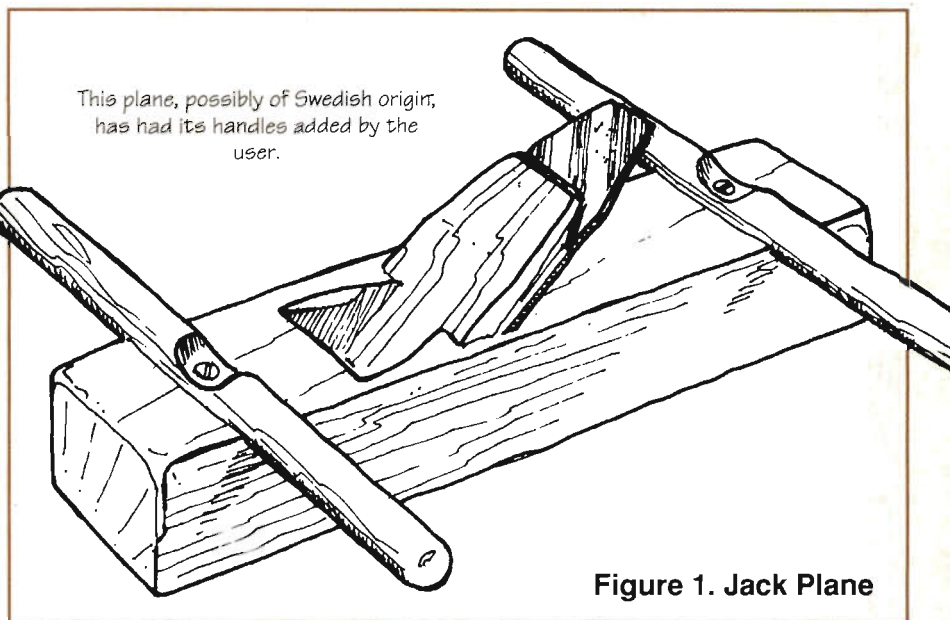


Figure 1. Jack Plane

myth discourages many who can't afford such tools. Further, it's easy enough to switch on the saw and push through a piece of wood, making a quick and fairly accurate cut, but to achieve any finesse, even on a power tool, requires skill that you won't develop as long as such a quick and easy method is so ready to hand.

The jack plane costs very much less than a planer, but when properly used produces finer work. It may seem easier and more efficient to push boards through a planer than to develop the skill needed to use the jack plane well, but look again. You could spend the same amount of time achieving handtool skills that it takes to earn the money to buy the power planer. And you won't suffer noise, dust, and the danger inherent in using power tools. Best of all, the results are truly finished—no sanding. Look at the impeccable woodwork produced in the last several hundred years—before power.

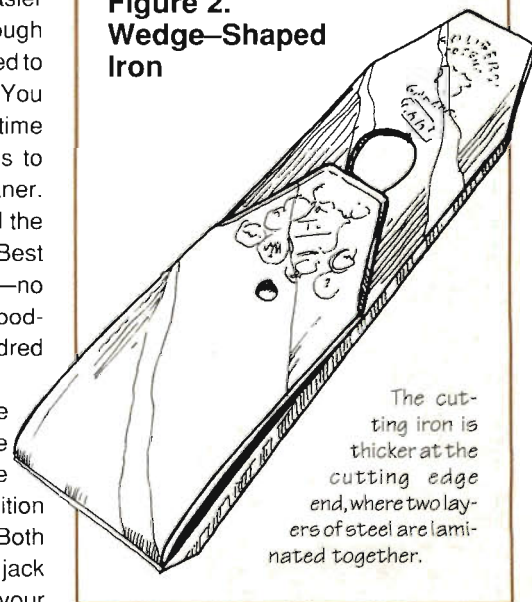
Machines work faster and do more in shorter time, but unless you make your living at woodwork, what's the rush? A jack plane is no harder to condition and maintain than a power planer. Both tools have edges to sharpen, but the jack planes are a little more forgiving when your

technique is less than perfect. Both adjust to take bigger or smaller shavings, but you can adjust the jack plane to produce a smooth surface.

The Jack Plane Defined

The jack plane is designed specifically to make a roughsawn board flat and true. Other "bench planes" aim at other tasks,

Figure 2. Wedge-Shaped Iron



such as really fine finish—smoothing or the easy creation of long, straight edges. But true to its name, the jack plane can be made to serve a variety of purposes. With it I can dress and surface rough boards, true their edges, and ready the surface for finish.

What defines a jack plane is a combination of length, blade profile and mouth opening. Within broad limits set by the user's skill and preferences, these are the same for any jack plane you might find, whether a brand new metal and plastic tool or an old wooden model at a flea market. Between these extremes are many other forms of the jack plane, including models made especially for master cabinetmakers that are themselves masterpieces of tool manufacture. Made of rosewood, with dovetailed metal bodies and gunmetal wedges, these "stuffed" tools (so called because their metal bodies were filled in with exotic hardwood) are the best, and their price now, a century later, is often more than the price of a power planer.

The length may vary from 14" to 18", and the width of the sole from 1¾" to 2½". The iron (blade) is essentially square, with a slight crown in the center which results in shavings thicker in the center than at the edges. The reason for this is simply ease of use, not to produce depression-like cuts—although that's the result. If you

Figure 3. Nineteenth Century Wooden Jack Plane

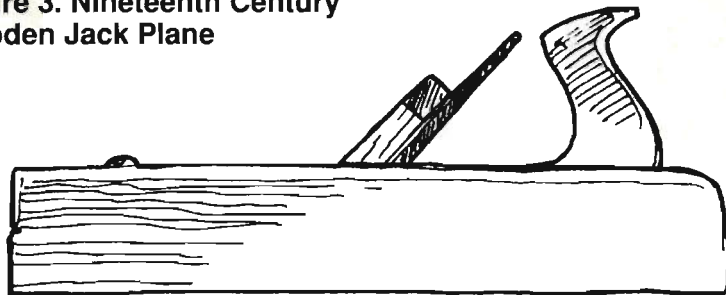


Figure 4. Stanley-type Metal Jack Plane

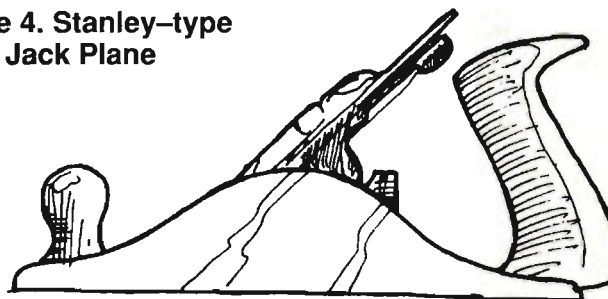
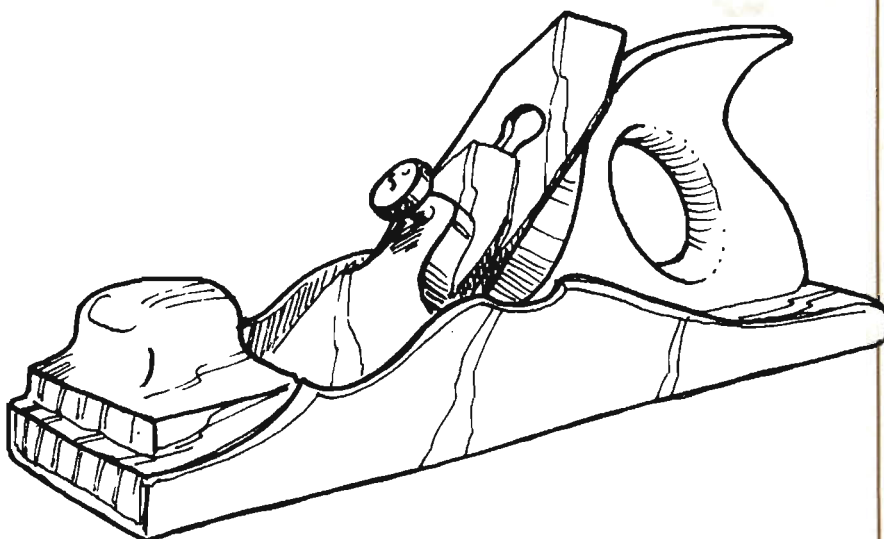


Figure 5. Stuffed Jack Plane



sharpen the blade *perfectly* square, the edges will dig in on any board wider than the cutting edge. The going gets very hard, especially when trying to remove a lot of wood at once—as required when dressing a rough and unflat board.

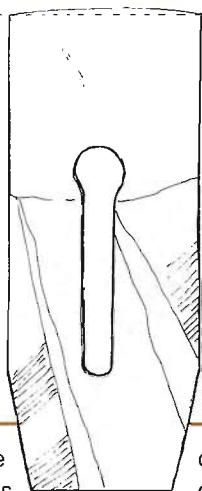
The finer the work, the slighter you can form this crown, but the thinner the shav-

ings you'll be able to take. This in fact is the reason for a smoothing plane—the plane used to produce the ultimate surface, where there is little reason left for thick shavings. Although it's possible to sharpen the edge with a very slight crown and use the tool for finish work, it's a bit of a waste, especially if you have a smoothing plane. The jack plane also has a fairly wide mouth, which can make taking perfectly clean thin shavings difficult.

The wider the mouth (the more space between the cutting edge and the sole before it), the thicker the shaving the edge can take up into the throat. Simply setting the blade more deeply so that more of it protrudes beneath the sole doesn't guarantee a thicker shaving. There must be enough room for it to pass up between the blade and the stock. A large mouth can accommodate a thick shaving and will allow you to set the blade deeply, or form a pronounced crown along the cutting edge and so remove a lot of wood with each pass. This is convenient initially on a board that's far from flat, or with big ridges or hairy saw marks, but eventually you'll want to take thinner and finer shavings. Then you'll want a plane with a narrower mouth

Figure 6.
Jack Plane Cutting Iron
Seen From Back

The amount of crown on the cutting edge shown here is fairly typical.



since the character of a shaving is determined not only by the shape and depth of the cutting edge, but also by how it's forced up into the plane's throat. If it's allowed to curl up unimpeded through a wide mouth, it's free to deflect and deform according to its grain structure. If that is pronounced and contrary to the direction of planing, tearout is likely. It's tearout that has led to the spurious maxim "always plane with the grain." Any woodworker who has planed anything other than the sweetest and most regularly-grained piece of wood will tell you the advice is often useless and impractical—wood just isn't made that way.

But if you use the right plane for the job, properly set and sharpened, you won't have to concern yourself with how the grain is running or whether it's rowed, curly, or just plain ornery. The secret of planing smoothly without concern for grain direction lies in a properly set iron (and capiron), and in a mouth narrow in relation to the thickness of the shaving. The principle is very simple: if you take a thin enough shaving and force it through a mouth just wide enough to receive it and no more, the effect of the capiron and the inside of the throat together will be to "break" the grain. This eliminates any tendency for the cut opening underneath the shaving to run back into the wood ahead of

the cutting edge. If the mouth is much wider than the thickness of the shaving, this effect is impossible, and tearout—when planing "against the grain"—is likely.

Since a jack plane is primarily used to remove a lot of wood at once, it usually has a fairly large mouth. If you set the blade shallower than you would for a thick shaving, you lose the support of the mouth necessary to break the shaving. For this reason it makes little sense to use the jack to produce fine shavings. In a pinch, and with care, it can be done, but it's usually easier to provide yourself with a smooth plane and leave the jack's blade set coarse.

Basic Adjustment

A wooden jack plane will almost certainly have a mouth wide enough to take substantial shavings. It may be too wide from use or abuse, and may need a little narrowing or *remouthing*—when a small piece of wood is mortised into the sole just ahead of the cutting edge so that the gap is reduced. Most metal-bodied jack planes, such as those made by Stanley or Record, are capable of mouth adjustment. The frog—the movable assembly holding the cutting iron, capiron and lever cap—is secured to the stock by two screws. When they're loosened, the frog can slide forwards or backwards to obtain the exact mouth width needed. Better quality metal-

bodied planes, such as older Stanleys, have more sophisticated and easily operated ways to move the frog so that the transverse alignment of the cutting edge remains unaltered.

A store-bought metal jack plane is unlikely to have the correct crown in its cutting edge. Creating this is part of sharpening plane irons, and is a skill that takes time to acquire. In fact, it's often said that learning to sharpen well is the hardest part of woodworking. Regard it as a challenge. The feeling of competence and control once you've mastered sharpening permits you to consider even the hardest projects and may be the most rewarding woodworking accomplishment.

Although there was a time when all planes had only a single iron, these are now rare—except for blockplanes whose low angle and reversed bevel in some measure compensates for this lack. The double iron (cutting iron and capiron) was a great advance. The curve and proximity of the capiron to the cutting edge greatly aids in breaking the shaving and preventing tearout. But when improperly adjusted, a double iron can lead to chattering, choking, accordion-shaped shavings...and the dreaded tearout.

To work at all, the capiron must seat perfectly against the back of the cutting iron. This implies an iron whose back has

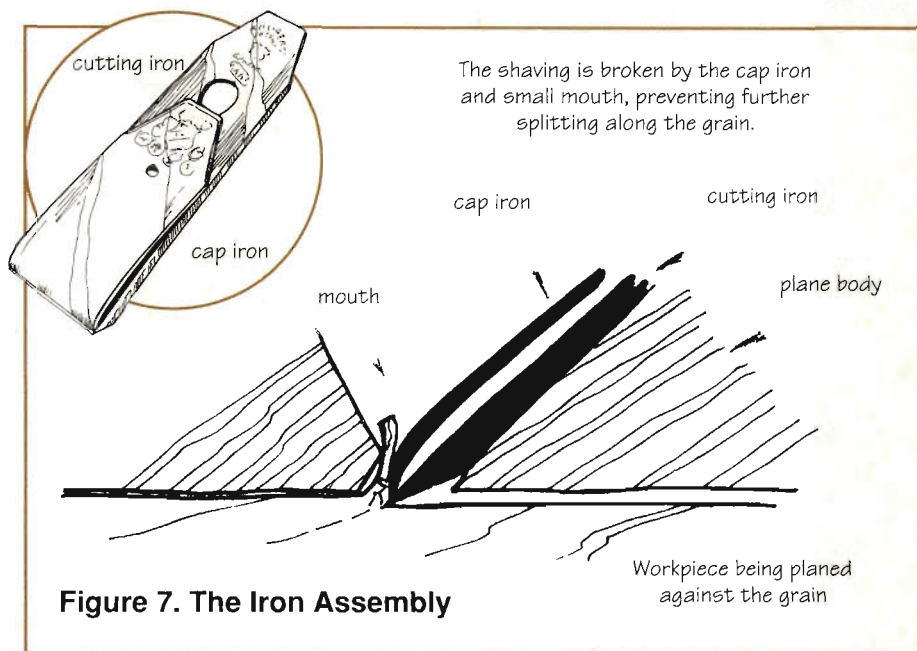


Figure 7. The Iron Assembly

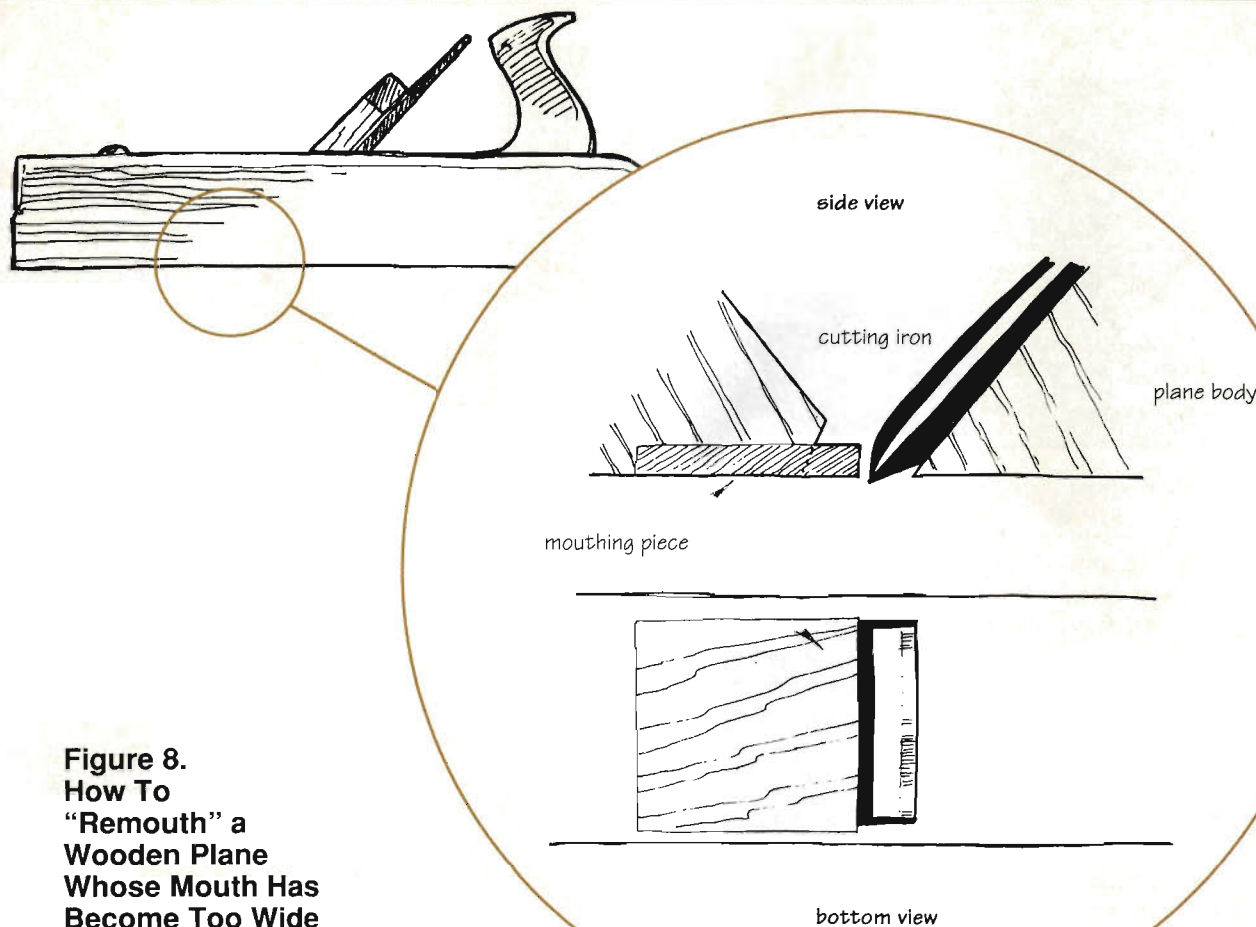


Figure 8.
How To
"Remouth" a
Wooden Plane
Whose Mouth
Has Become Too Wide

been made absolutely flat, with the aid of a diamond stone or some other trusted reference. There should be no light visible between the two, and the outer, leading edge of the capiron must be the only part to contact the cutting iron. For this to happen, the capiron must be almost as sharp as the cutting iron. It must be perfectly square. When thus prepared it can fit against the back of the cutting edge so that it supports the bevel of the edge toward the center of the crown and lies almost equal with the corners. Setting the capiron closer or further from the edge helps set the thickness of shaving. The difference, however, is slight—for the very thickest shaving, the capiron should be no further than $\frac{1}{8}$ " from the cutting edge. For the thinnest shaving it should be so close that only a sliver of the cutting edge is visible—which requires only a very slight crown.

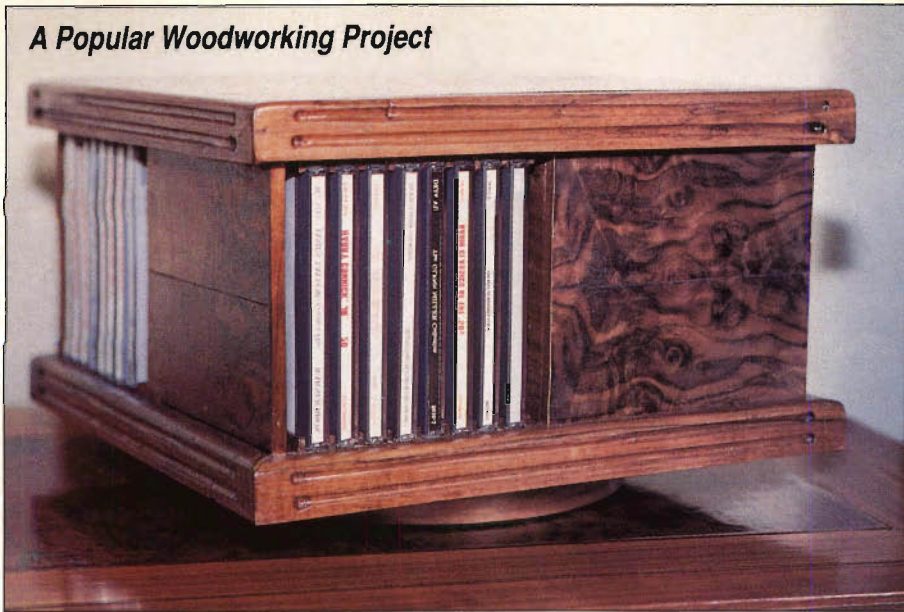
No plane can produce a surface flatter than its own sole. If a wooden jack plane's sole is rounded or warped, it must be trued, usually by planing it with a truer plane. You can do this by running the plane over a jointer and then finishing the sole with a smoothing plane for absolute flatness. A metal plane is somewhat more difficult to true since it must be lapped on a known flat surface. Machine shops may do this for a price. But make sure they flatten the sole with the iron in place (and retracted) so that the stock (plane body) is in the same state of tension and compression as it will be in use, when either the wedge or the lever cap will be fully employed in holding the iron in position.

It follows that the iron-holding mechanism must work well and securely, whether it consists simply of a wooden wedge accurately bearing against the iron—which

in turn must seat securely against the plane's bed—or whether it involves the metal frog and lever cap assembly common to metal planes. You can't rely on a loose iron. And if the jack plane is handled—whether with a single tote or the double transverse handles mentioned at the start of this article—these must also be securely mounted and without wobble.

Whatever is stamped on the iron is usually irrelevant, consisting usually of makers' names and other forms of advertising. This may be interesting to collectors and useful as a guide to quality if you're familiar with the various foundries that produced the irons, but the test of the iron is how well it can be sharpened and how long it will hold its edge—the laminated, wedge-shaped irons common with wooden jack planes being usually all considerably better than contemporary alloyed irons. **PW**

A Popular Woodworking Project



by Ralph N. Nilsen

This compact disc holder has room for thirty—two CD's in a small space. It rotates for easy access to the CD of your choice.

Before you cut the top and bottom (A) to the dimensions given in the Cutting List, mill the rabbets and grooves. I used $\frac{5}{4}$ stock for two reasons—I wanted to use $\frac{1}{4}$ " splines, and the material was on hand. If you use biscuit joints, $\frac{3}{4}$ " stock is fine.

I cut the rabbets and grooves shown in Figure 1 with my radial arm saw in the rip position; use a table saw if you prefer. First cut a $\frac{3}{16}$ " rabbet on one edge, $\frac{1}{4}$ " deep. Then moved the blade (if you're using a table saw, reset the fence) so that it leaves a $\frac{3}{8}$ " land between the rabbet and the next groove (see the photo to the right). Cut this groove, then cut eight more, with a $\frac{7}{16}$ " space between each. Assuming your saw blade is $\frac{1}{8}$ " thick, you'll move the saw (or the fence) out $\frac{9}{16}$ " for each groove. Cut the rabbet on the far edge $\frac{3}{8}$ " from the last groove as shown in Figures 1 and 2. This should leave a strong $\frac{1}{4}$ " rabbet, perfect for the lauan plywood side panels (B) which will be .260" thick after veneering.

Cut this grooved plank into the eight $5\frac{3}{4}$ " square pieces. Position four top and four bottom pieces so that the grooves run in alternate directions with the $\frac{3}{16}$ " rabbet forming a cross on the centerlines (Figure 2). Each piece needs another $\frac{3}{16}$ " rabbet cut across one end to make the "cross" groove $\frac{3}{8}$ " wide. Finally, widen the four $\frac{3}{16}$ " rabbets on the outside edge to $\frac{1}{4}$ " to accept the side panels.

Ralph N. Nilsen is a woodworker in Richmond, Texas.

With the four pieces loosely assembled, mark the edges requiring joining. The four pieces that make up a top or a bottom are glued together using splines. Cut the spline grooves on a router table setup using a $\frac{1}{4}$ " slot cutter. Since the top and bottom pieces are to have edge moulding, you can cut the grooves the full length of the piece (Figure 1). I used $\frac{1}{4}$ " tempered hardboard for splines (C). Assemble the top and bottom pieces making sure the grooves run in alternate directions; clamp, and allow the assemblies to set overnight.

Make the center cross supports (D) of

Cutting rabbets and grooves in $5\frac{3}{4}$ " wide, 48" long stock, $\frac{5}{4}$ " thick. Use push sticks.



A Compact Disk Carousel

$\frac{3}{8}$ " plywood, with the grain running in the short direction to provide vertical edges to support the side pieces. Cut a $\frac{3}{8}$ " wide slot to the center of each piece, so that the pieces, when assembled, intersect, forming an egg-crate joint. I applied walnut veneer to the side panels and the center cross, keeping it $\frac{1}{4}$ " from the edges, so that they'll fit in the $\frac{3}{8}$ " groove in the top and bottom pieces (see Figure 3).

Cut the divider strips (E) from $\frac{1}{8}$ " stock. This can be tricky—since the table saw safety guard will not be effective in preventing kick-back of such small stock, remove it. The standard table saw throat plate also has too much clearance for $\frac{1}{8}$ "

Compact Disk Carousel					
Cutting List					
Qty	Part	Finished Size			Piece
		T	W	L	
8	A	1"	5¾"	5¾"	top & bottom
4	B	¼"	5½"	6"	side panels
8	C	¼"	11½"	5¾"	splines
2	D	⅜"	10⅞"	5⅝"	cross supports
72	E	⅛"	10⅞"	5"	divider strips
8	F	½"	1"	12⅞"	moulding
1	G	¾"	9" dia.		turntable
Supplies					
4" lazy susan					
veneer					
felt & iron-on edging					

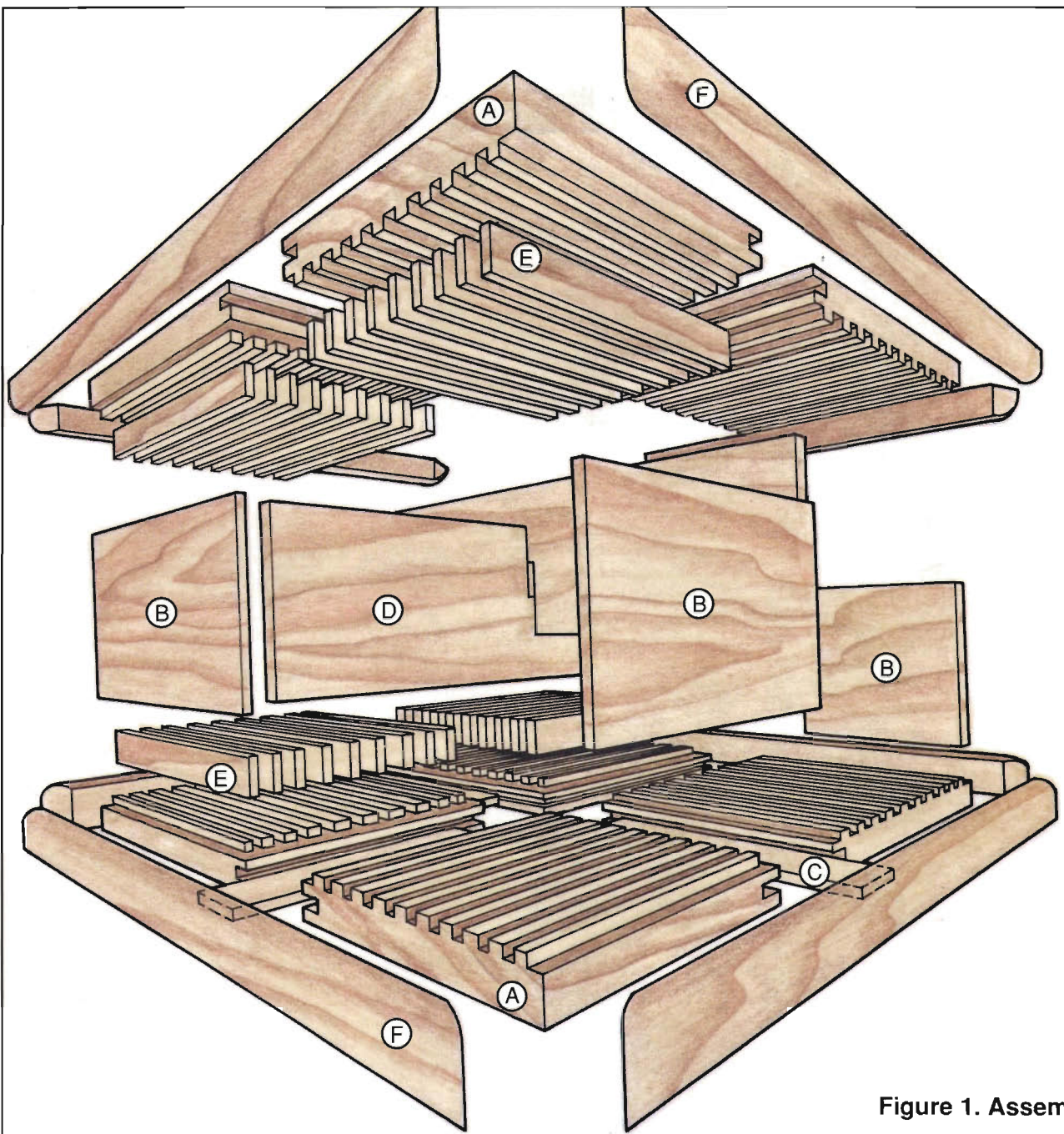


Figure 1. Assembly

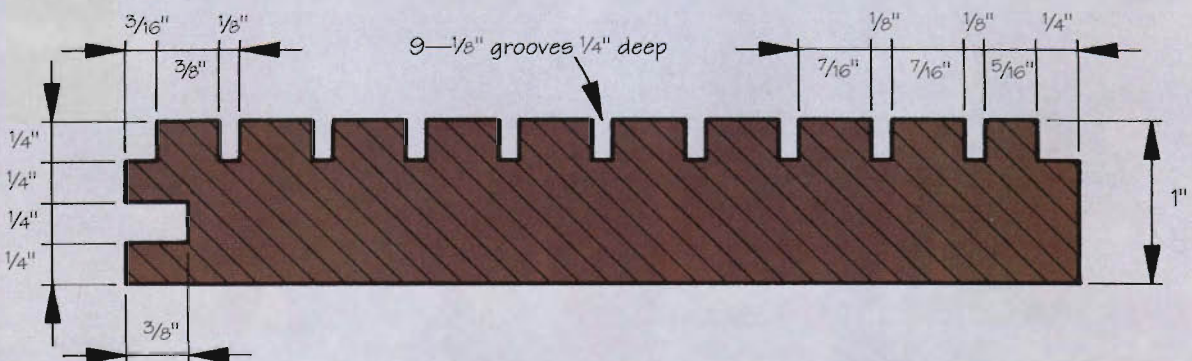
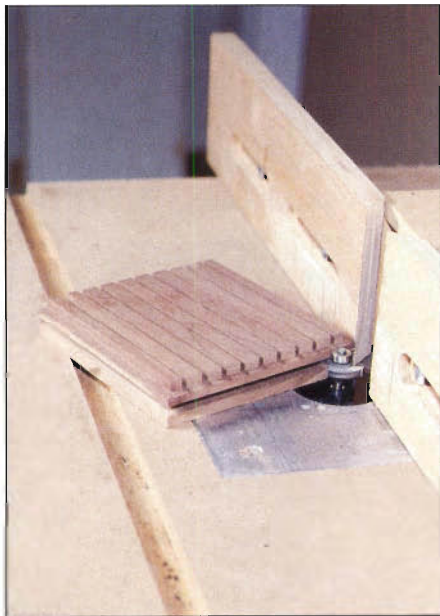
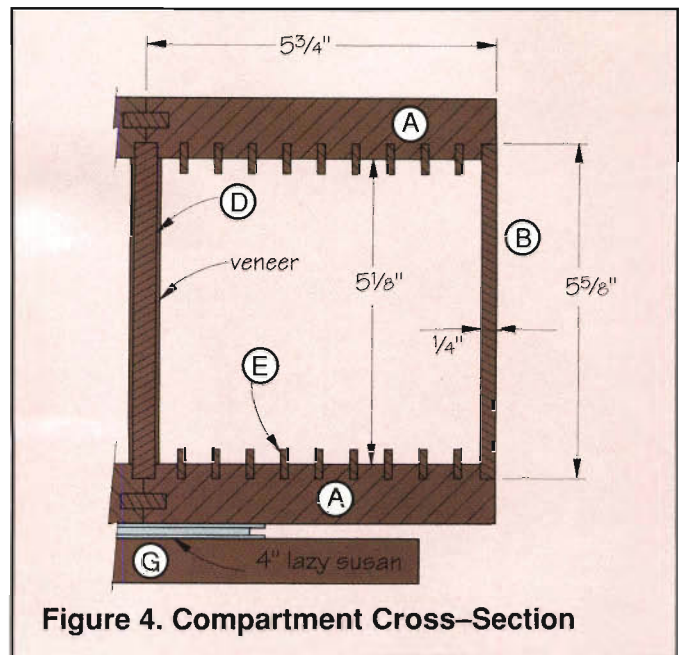
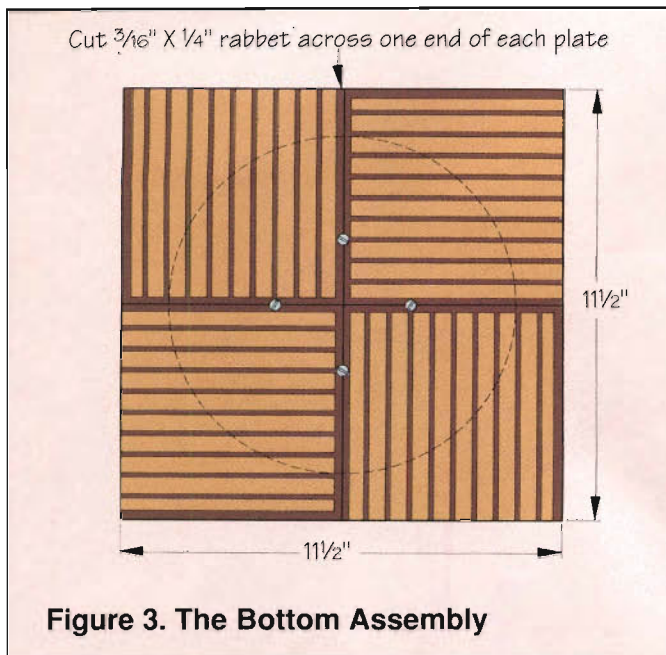


Figure 2. Rabbets and Grooves



Cut the grooves the full length of the piece. Unused spline grooves will be covered with moulding.

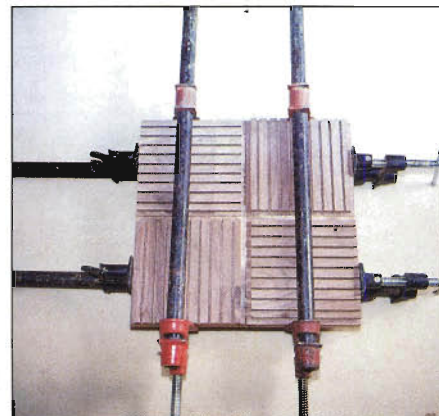
Remember to alternate grooves and rabbets before gluing in the spines.



stock. Set the fence $\frac{1}{8}$ " from the blade and lower the blade below the table surface. Clamp a piece of tempered hardboard or scrap plywood to the table top so it butts against the fence. Start the saw and raise the blade through the sheet, creating a zero-clearance table insert. Use a push block to push the material through the blade and a feather board to keep the stock against the fence.

Cut the moulding pieces (F) wide enough to cover the edges, and long enough to permit mitered corners. If you like, make wider moulding for the bottom to act as a skirt and cover the turntable. To add more interest to the moulding, cut two decorative grooves with a $\frac{3}{16}$ " veining bit on the router table. Position the router fence so that the groove is centered $\frac{1}{4}$ " from the edge of the moulding piece. Mark the starting and stopping point of the groove on the router fence so that you will stop the

Position the ends so they're flush and secure by cross-clamping.

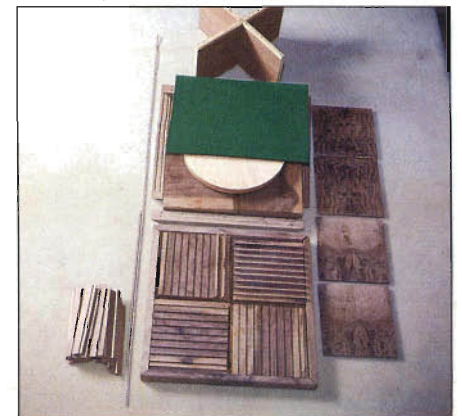


cut $\frac{3}{4}$ " from the ends. Make one cut, turn the piece end for end, and cut the second groove.

Cut the turntable (G) from $\frac{3}{4}$ " plywood to the dimensions in the cutting list. Attach the lazy susan to the bottom assembly and countersink the screws through the grooves for the center cross support. Cover the edge of the turntable with iron-on edging, and the bottom with sticky-back felt. After sanding the parts, glue in the divider strips. Glue the center cross support onto the bottom assembly. Next, glue and tap the top into place, then the side panels. Finally, glue and clamp the moulding pieces to the top and bottom edges.

The top will require a final sanding with 220-grit sandpaper. I used two coats of a natural wax and two coats of satin polyurethane, sanding between coats with wet/dry 600-grit paper and mineral spirits and a final buff with 0000 steel wool. **PW**

Make sure all the parts fit before final assembly.



Knickknack Shelf

by Jeff Greef

This shelf can be mounted on a wall or set on top of another piece of furniture. It is ideal for displaying all of the choice knickknacks you've collected while browsing antique shops.

Begin by planing all of your stock to a thickness of $\frac{5}{16}$ ". If you don't have a planer, find a local cabinet shop or lumberyard that will do it for you. As an alternative, resaw 3" wide stock on your table saw; then edge-glue the thin pieces together. If you cut your stock on the table saw, make the cuts in stages—first with the blade about $\frac{3}{4}$ " above the table. Make the cut on one edge, flip the piece end for end, and make the cut on the opposite edge referencing the same face against the fence. Cut the pieces slightly thicker than called for and glue up the panels. When the glue has dried, sand to size.

Dadoes

Cut the stock for the sides (A) and shelves (B) to the dimensions given in the Cutting List. Measure and mark the sides

Jeff Greef works wood and writes about it in Santa Cruz, California.



Cut the dadoes in the sides and shelves with a router and a straight edge.



A homemade guide block will keep your cuts accurate on the scroll saw.



Use a drum sander in your drill press to remove the blade marks.



isn't centered on the base this distance will vary. If your router is off-center, be sure to reference the same spot against the fence that you used to set the placement of the fence.

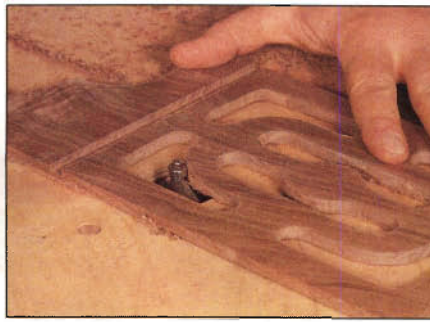
If you cut with the router going right to left, the bit tends to pull the router away from the fence; if you cut in the opposite direction, the bit tends to pull the router toward the fence. Make all your cuts with the router pressed tightly against the fence. Move the router slowly as you come out of the cut to avoid tearout. Another method to prevent tearout is to rout the dadoes before you rip the piece to width.

Scroll Cuts

Trace the pattern from the PullOut™ Plans onto one side. Use the same pattern for the upper and lower cutouts. Nail the two sides together with small brads in the waste areas before you cut out the patterns. Predrill the nail holes if you're using hardwoods, so the wood doesn't split. Clamp the sides in a vise and bore a $\frac{3}{8}$ " hole in each cutout area.



Use a file and sandpaper for hard-to-reach areas.



Round over the scroll-cut edges on the router table.

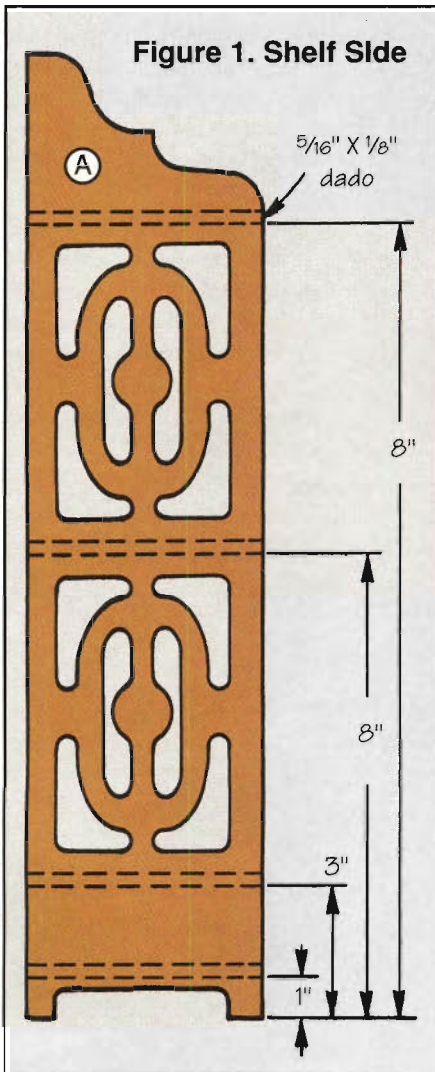


Figure 1. Shelf Side

Thread the scroll saw blade through one of the holes, reattach the blade to the machine, and cut out the waste. Let the saw cut at its own speed—don't force it or you'll break the blade. Cut to the outside of the pattern lines so the spaces are at least $\frac{1}{2}$ " wide, to accommodate the drum sander you'll use to smooth the edges.

Once the waste areas are cut out, separate the two sides. Put a $\frac{1}{2}$ " drum sander in your drill press and sand the curves smooth—unless, unlike me, you're so good on the scroll saw that you don't need to! In a few spots the drum sander may contact the wood on both sides; go slowly and let the sander cut at its own speed. Use a rough grit first; then follow up with finer grits for a smooth surface. If you don't have a drill press, put the drum sander in a hand-held drill, or file and sand by hand. The $\frac{1}{2}$ " sander won't fit in the area around the central circle. Smooth this area with a file and sandpaper.

I beveled the edges of the pattern with a 45° chamfering bit on my router table (photo above). You can also use a round over bit. Set the bit low enough in the router so the bearing contacts the edge of the wood. Make the cuts fairly quickly to avoid any router burn, and keep your fingers away from the bit. As an alternative, you can round over the edges by hand with sandpaper.

Knickknack Shelf					
Cutting List					
Qty	Part	Finished Size			Piece
		T	W	L	
2	A	$\frac{5}{16}$ "	6"	24"	sides
4	B	$\frac{5}{16}$ "	6"	$18\frac{1}{4}$ "	shelves
1	C	$\frac{5}{16}$ "	$2\frac{1}{4}$ "	6"	divider
2	D	$\frac{5}{16}$ "	$11\frac{5}{16}$ "	$8\frac{13}{16}$ "	drawer fronts
2	E	$\frac{5}{16}$ "	$11\frac{1}{16}$ "	$8\frac{13}{16}$ "	drawer rears
4	F	$\frac{5}{16}$ "	$11\frac{1}{16}$ "	$5\frac{1}{4}$ "	drawer sides
2	G	$\frac{5}{16}$ "	$5\frac{3}{8}$ "	$8\frac{13}{16}$ "	drawer bottoms
4	H	$\frac{1}{4}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "	drawer stops
4	I	$\frac{5}{16}$ "	$\frac{1}{2}$ "	$1\frac{3}{4}$ "	cleats

Drawer Divider

Use the router to cut the dadoes in the two shelves that hold the small divider (C) between the drawers as shown in Figure 1. Place the shelves edge to edge, clamp them to the workbench and make the cut. Fit the divider in the dadoes and tap the shelves together. Be gentle with your mallet on these thin parts. Drill holes for the nails if you're using a hardwood and set them with a nailset. There's no need to glue the divider—it's locked in place.

Assembly

Put a bead of glue in the dadoes on one side and fit the two lower shelves with the divider; then set the two upper shelves in place. Spread glue in the dadoes on the other side; put it in place on the four shelves, and tap it down with a mallet. Check the assembly for square. If the shelves fit snugly in the dadoes you shouldn't need clamps—if it's loose, clamp it together. Drill for nails, and tap them into the dado joints.

Dadoes snugly hold the drawer divider.



Check for square before nailing.



Predrill the holes for the finish nails.



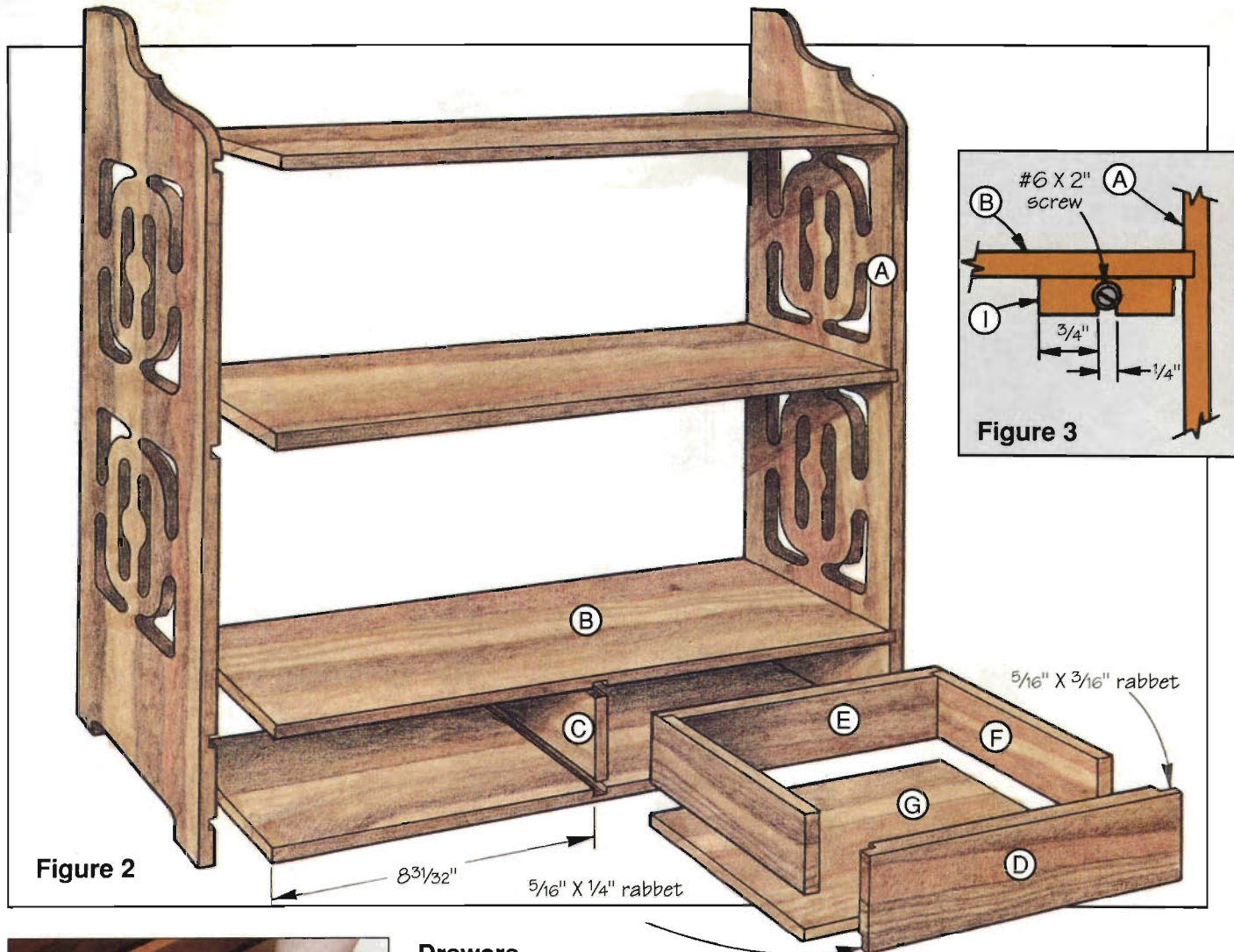


Figure 2

Figure 3



It will take several passes with a $\frac{1}{8}$ " blade to rabbet the drawers. Use the miter gauge for the sides of the fronts and backs and the fence for the bottom of the fronts.



Drawers

Cut the drawer pieces (D, E, F and G) to size. Cut rabbets in the ends of the front (D) and rear (E) to accept the sides (F) as shown below. Set the table saw fence at $\frac{5}{16}$ " from the outer edge of the blade. Set the blade on your table saw to $\frac{3}{16}$ ". Use the miter gauge set at 90° to guide the cut. First, butt the end of the piece against the fence and push through the cut. Then move the piece $\frac{1}{8}$ " away from the fence and cut again. One more similar cut will clear out the rabbet. Cut the rabbet along the bottom edge of the drawer fronts for the leading edge of the drawer bottom (G). Set the blade height to $\frac{3}{16}$ " and the rip

fence to $\frac{1}{4}$ ". Make this cut, then move the fence close to the blade—but not touching it. Cut again to clear most of the waste then clear the remainder of the waste with a chisel.

To assemble the drawers, place a front or rear piece in the vise as shown in the lower right, and drill the holes for the nails. Apply glue to the joint, and nail the pieces together. Glue the drawer stops (H) at the rear of the lowest shelf, so the drawers are flush with the front when they're closed. Use two stops for each drawer—one on each side.

It's best to secure a shelf containing valuables directly to the studs in the wall rather than to the plaster or drywall alone. Glue four small cleats (I) onto the bottom rear of the top shelf as shown in Figure 3—use leftover $\frac{5}{16}$ " scrap. Place a washer on each screw to hold the shelf securely against the wall. You can also use drywall mollies for this lightweight shelf, but if you do, don't use it to display your prized collection of lead weights. **PW**

Glue and nail the drawers together.



Typing on Wheels

by Tom Crabb

When a computer came into our house I had no idea how much room it would take. With the computer set up and ready, my typewriter found itself on the floor. Typewriters are still very handy—the problem is to keep them both handy and out of the way. I solved this problem with wheels that allow the typewriter to stand still, or to roll forward, backward and side to side.

Two wheels are mounted in tandem and two in parallel. If you lift one end of the stand it will roll from side to side. If you lift the other end it will roll forward and backward. With all four wheels on the floor it doesn't roll at all. The height selected here

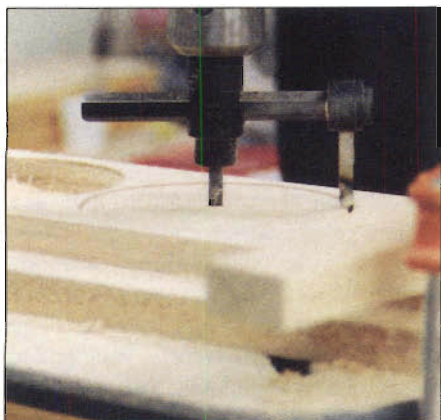
is suitable for a chair with a seat about 16" high. By lengthening the legs, you can match a different seat height accordingly. Our typewriter stand is made from red oak, but almost anything will do.

The project goes quickly if you start at the bottom and work up. The wheels (A) are a good warm up. Draw four 4½" squares on your hardwood; then measure diagonals from corner to corner to mark the center. Draw a 4" diameter circle with a compass. Use a band saw to cut the wheels, cutting wide of the compass line, then sanding to the line on a belt or disc sander. Another method would be to use a

fly-cutter in a drill press. Sand ⅓" off each face of the wheels to make them all approximately 1¼" thick. Use a ⅛" round-over bit in your table-mounted router to ease the edges of the wheels.

A quick method for machining the remaining parts is to begin with 4" wide stock. Cut one length for each of the matching pairs of rails (B, C and D), as mentioned in Cutting List. Cut the dados and rabbets as shown in Figures 1 and 2; then rip these 4" wide pieces down the center and dress to 1¾" finished width. Note that you'll need to rip the end rail board just before you cut the last of the dados

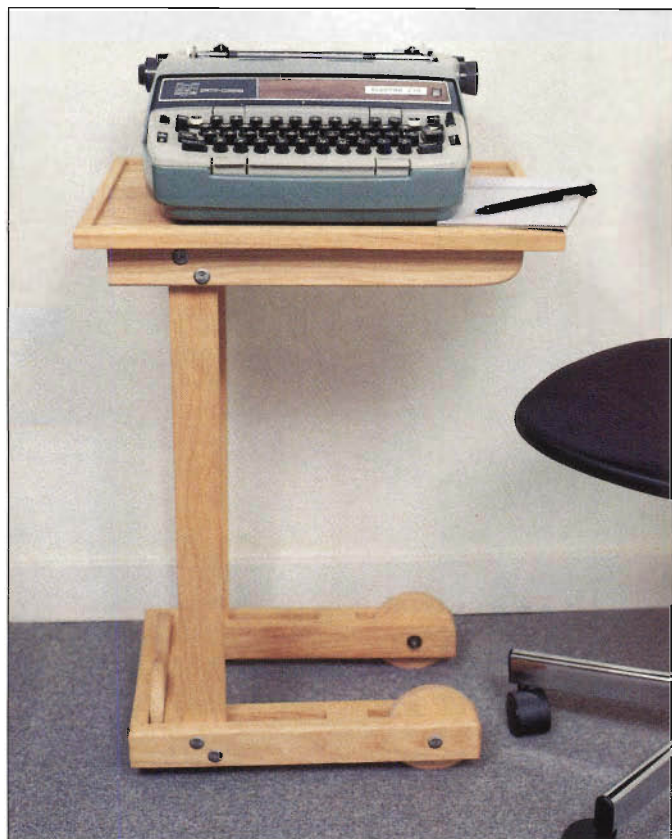
Cut the 4" wheels using a circle cutter. Remember that a 4" diameter circle is 2" from the center point to the perimeter.



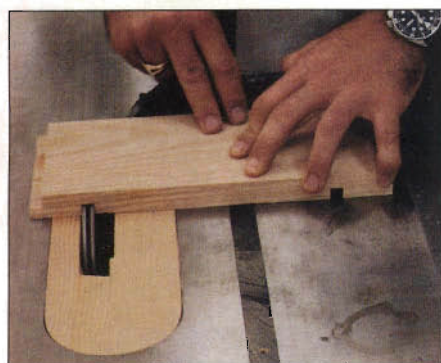
Round all four wheels at the same time on the sander by connecting them in the center with a dowel.



Use a panel cutter jig to cut the top. This is easily made with plywood and a hardwood strip that fits into the miter gauge slot.



Bruce Richmond

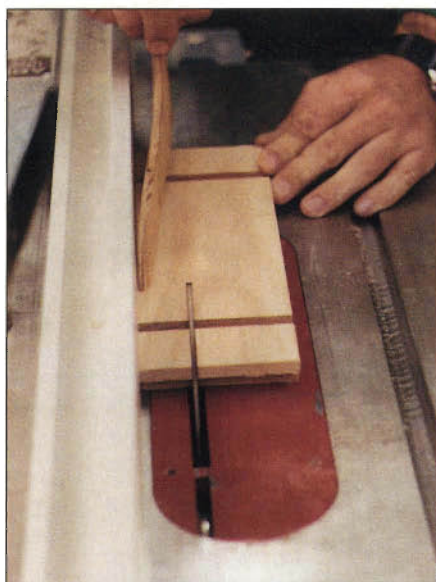


Cut the dadoes and rabbets on stock twice as wide as needed for parts B, C and D.

because you'll cut them only on the inside end rail (D) (Figure 2). Drill the holes and round the ends of these parts as shown in the Figure. Taping the matching pieces together helps uniformity.

If you use SAS lumber, you might want to use 1 X 6's. In this case it would be more convenient and result in less waste. Make all the parts 2" wide instead of 1 3/4". Just locate the wheel holes on center.

Dry assemble the inside front and back rails (B) to the inside end rail (D). Then add the outside front and back rails (C) and the outside end rail to the assembly. These pieces can be glued and clamped or glued and screwed. With the spacer blocks (E) glued in place, the base assembly is complete. Rounding over the top edges of the base with a 1/4" or larger bit gives a softer look and snag-free edges.



Rip the dadoed and rabbetted stock to the 1 3/4" width needed for parts B, C and D.

At this point I suggest you install the wheels (Figure 3) and roll the base around a little, just for fun.

To attach the legs (F) to the base, remove the wheels and set the base on a flat surface. Slide the legs in between the rails until they bottom out on the flat surface. Square the legs to the front or back rails with a framing square. Hold them in position with clamps if the legs will not hold their own position.

Since the top is cantilevered, I recommend bolts for connecting the top rail (G)



Dry assemble the parts, then glue and screw them together. Drill countersunk pilot holes and drive the screws in from the insides of the rails through the spacer blocks.



Attach the moulding to the top (H) using a framing clamp. Remember to make the moulding groove large enough for the added width of the veneer.

Use a scrap 2X4 to help clamp the top rails to the legs. Drill the holes, then glue and screw the rails in place.



Figure 1. Inner and Outer End Rails

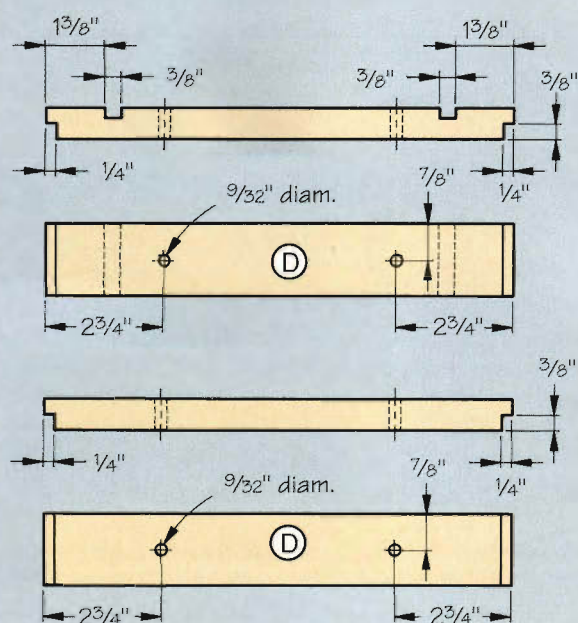
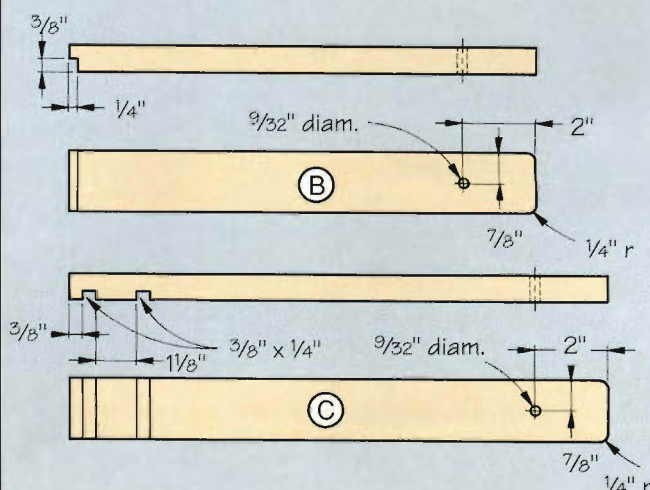


Figure 2. Inner and Outer rails





Square the top to the top support assembly and clamp them together.

to the legs. Two 1/4"-20 Allen head bolts with nuts per leg, with the nuts and bolts painted to match or contrast with your intended finish will work well. These are available from SMC Quality Wood Products, P.O. Box 479, Rutherford, CA 94573. Drill two 9/32" diameter holes through to the inside of the base for each connection. Do one bolt at a time, and check for square as you tighten the nut.

Glue and clamp the spacers (E) between two top rails to match the spacing of the bottom space blocks. The top rails are attached in the similar manner as the legs, but have a 2 1/4" overhang. Here it may be helpful to clamp a squared 2X4 block of wood to the leg to help support the top rails while drilling the holes.

The top (H) is made from plywood. Cut it to the dimensions in the Cutting List and cut a 1/4" X 1/4" rabbet on all four edges as shown in Figure 4. Mill some moulding stock (I) as shown and miter it to fit around



Mark the space between the legs and spacers with a pencil for the top foot placement.

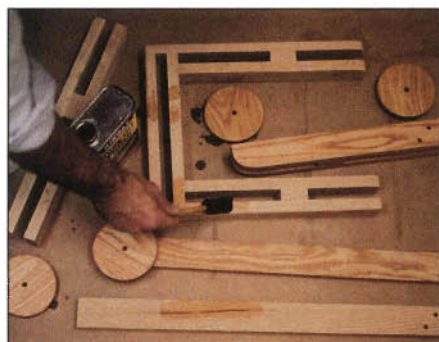
the top. You can orient the top with the rabbet down to create a small lip around the top.

Set the top on the stand with the inside edge of the moulding butted to the square ends of the top rails. Adjust it to equal distances front-to-back and clamp in place.

Slide the top feet (J) between the top rails and glue and screw them to the underside of the top, with the screws set a little below flush. The top feet sit firmly between the top rails which makes the top removable. I covered the top's show side with red oak veneer.



Screw the top feet to the top while everything is still clamped in place.



Disassemble the parts to finish them with tung oil or stain and varnish.

To finish the stand, disassemble it as far as you can, finish the parts separately; then reassemble it. My stand simply has a coat of tung oil. Once the finish has cured, the stand is ready to roll. **PW**

Beauty Skin Deep—Veneer



Cut the veneer with scissors or a veneer knife. Make it oversized because you will trim it to the edges of your top later.



Brush the top of the table with contact cement, following the directions on the can. Make sure you have adequate ventilation.



Apply contact cement to the underside of the veneer in an uniform coat brushing the cement in one direction.

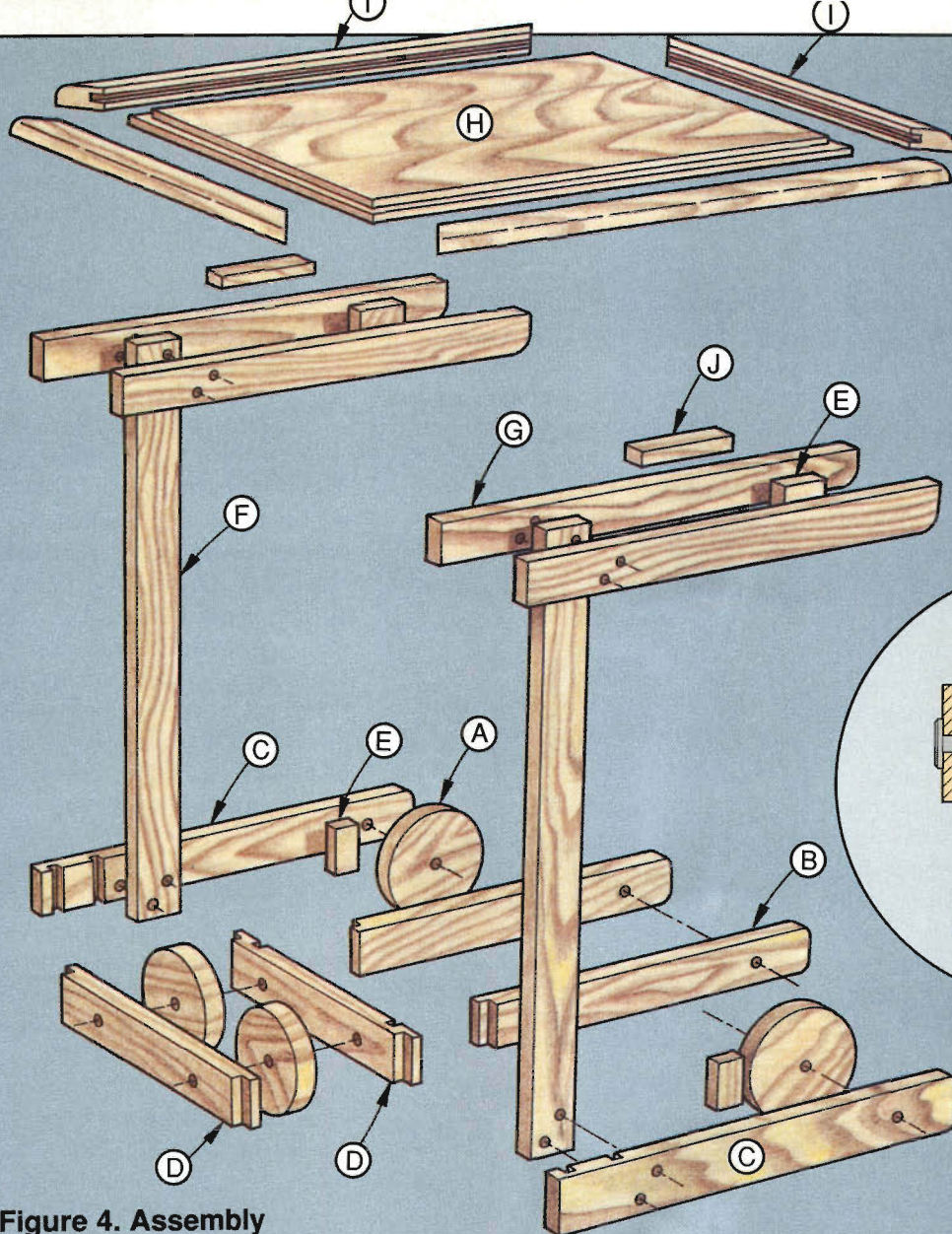


Figure 4. Assembly

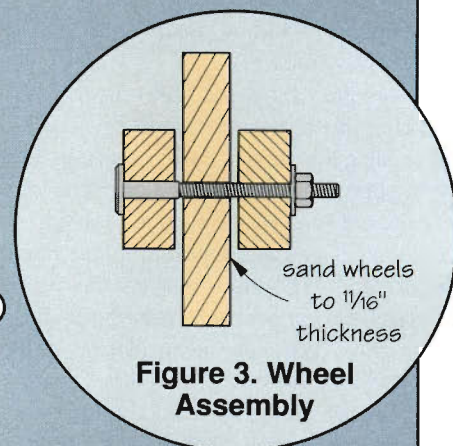


Figure 3. Wheel Assembly



Let the cement cure for 15 minutes, then position the veneer. Align it carefully before you press the veneer down permanently.



With a veneer knife or single edge razor, make several light passes rather than one heavy cut to trim the veneer to size.

Typing on Wheels

Cutting List

Qty	Part	Finished Size			Piece
		T	W	L	
4	A	4" diam	1 1/16"		wheels
2	B	3/4"	1 3/4"	13"	inner side rails
2	C	3/4"	1 3/4"	15"	outer side rails
2	D	3/4"	1 3/4"	11"	end rails
4	E	3/4"	1 3/4"	1 3/4"	spacer blocks
2	F	3/4"	1 3/4"	23"	legs
4	G	3/4"	1 3/4"	16"	top rails
1	H	1/2"	13 1/2"	17 1/2"	top
1	I	3/4"	1"	72"	moulding
2	J	3/4"	1/2"	4"	top feet

Adventures in Veneering

by David G. Cargo

Some years ago, I bought a very old house which included some antique furniture. The dining room chairs are made with sturdy frames of solid oak and thin oak veneer saddle seats. The laminated seats became badly splintered and broken, and with use became unsittable. The poor condition of the chairs prompted me to learn how to veneer the seats.

I began by ordering veneering supplies and tools by mail.

I removed the bent oak braces fastened to the back and seat of one chair. After filling the gaps in the existing veneer with wood dough, I injected glue into all narrow crevices with a syringe to re-glue the loose places where the old veneer had separated. A portable belt sander with medium-grit paper sanded flush the places where the old veneer had buckled upward into a ridge. An orbital or palm sander would work equally well. Last, I sanded the seat smooth to provide a surface to accept the new veneer. The chair was ready to be recovered.

Since I had seven chairs to repair, I made a cardboard pattern of the seat. Where crosscutting was needed, I cut extra-long lengths of the veneer with a curved blade veneer saw. Practice cutting with this tool on some veneer scraps to gain confidence and skill. Clamp a framing square at both ends across the top of the veneer sheet to guide the saw for straight cuts. As you cut pull slightly into the straight edge so the knife stays on line. The chair seats were so wide that I needed two seams for each repair, requiring straight edges where the sheets joined. You can make these cuts with a sharp utility knife, but I found that the veneer saw does the job flawlessly, and usually in one or two strokes.

Join the prepared veneer sheets by overlapping the edges or by butting them together. Since there was considerable front-to-rear scooping in the original seat design, I was concerned that the sheets might pull apart in the middle when applied

in the concave areas. So I used the overlap method on the first chair. I applied two coats of contact cement to both the seat and the back of the first veneer sheet, allowing 20 minutes drying time between applications. This first sheet was laid down and rolled firmly with a small veneer roller.



Before—Though the grain was beautiful, the gaps in the veneer spoiled its looks.

After—A comfortable, good-looking seat.



I protected the joining edge with masking tape, then prepared the second sheet with contact cement. Starting at the rear, I carefully pressed this sheet down, allowing about 1/2" to overlap the first sheet. This edge was rolled with heavy pressure, then I cut off the overlapping strip with a utility knife. After positioning the second sheet, an unacceptable gap appeared that required filling before refinishing. In retro-

spect this method was not the best for this particular application.

I used the second method, which requires paper veneer tape on the remaining chairs. This method allows the many veneer sheets to be installed as a single sheet. The veneer comes with straight edges for joining; I butted them tightly against each other on a soft wooden surface and held them in place with push pins, spaced about 1" away from the joint. I moistened and applied the tape along the length of the joint on the finish side. After drying overnight, the pins were removed and the assembly cut to 1/2" oversize. I glued it in place using contact cement as described above, and press-rolled it thoroughly.

Sanding the veneer and the overhanging edge with a 2" drum sander in a 3/8" reversible drill worked most efficiently. It's best to have the drum rotate downward onto the veneer—this gives a very clean edge. Certain corners required reversing the rotation of the drill. I sanded the new seat with an orbital sander, using 80-grit open coat sandpaper. I did the finishing sanding and beveling of the edges with a palm sander and 120-grit paper.

Where the drum sander had scuffed the supporting members, and to the seats, I applied two coats of MINWAX stain/sealer that closely matched the chair color. Two coats of satin polyurethane, lightly rubbed with fine steel wool, and a coat of paste wax completed the refinishing process. I reinstalled the angle braces after predrilling the holes for the screws in the veneer.

The before and after photos show the improvement and how closely the new seats matched the original chairs. These chairs, according to the faded paper labels glued to the undersides of the seats, were made in Sheboygan, Wisconsin and patented in 1899. My first-time success with veneering has prompted me to plan further restorations, and I encourage anyone to take the plunge. Veneering is a quick and easy way to apply a beautiful surface to any project, old or new. **PW**

David G. Cargo is a marine zoologist and woodworking hobbyist.



Southwestern High-Back Chair

by Kingsley Hammett

Building something to sit on is not that difficult. Building a chair you hope will last several generations is a task that can take Miguel Chavez as long as three days. After years of specializing in chairs, he has streamlined his operation with the help of useful jigs to get accurate measurements on repetitive cuts. The end result is a graceful, comfortable chair with through mortise and tenon joints that fit like a cork in a bottle.

Since there are a number of repeat steps in building chairs, Chavez never builds one at a time. If he has an order for six, he'll mill out and set aside parts for twelve.

Kingsley Hammett is the owner of Fine Additions and publisher of Once a Tree, a catalog of wood product manufacturers.

This way he has a head start on the next order. He likes to work in New Mexico ponderosa pine or sugar pine, and starts with air-dried stock in $\frac{3}{4}$ and $\frac{1}{4}$, #2 or better.

Chavez starts with a template and traces the outline of one back leg onto a wide piece of stock (A). He cuts the front angle on the band saw and smooths it up on the jointer. He sets the band saw fence at 2", and runs the stock through holding the front surface against the fence following the bend and cutting off a leg. Then he joints the two flats and repeats this sequence for as many legs as the stock will yield. The top of each back leg is cut with three $\frac{1}{4}$ " steps, a traditional New Mexico motif that reflects the profiles



Miguel "Mike" Chavez Chavez Woodworks

Mike Chavez is a leaf on an enormous family tree that was planted in the 16th century somewhere in the Rio Grande Valley and today spreads its branches throughout the state of New Mexico. His love for the history of this tree is the inspiration for Chavez as a Santa Fe furnituremaker.

Like so many of his contemporaries, Chavez is imbued with the self-reliance that marked his forebears. His grandfather was a farmer and rancher on the eastern plains who built his own houses and carved his own *santos* (carved figures of saints). His father rose from carpenter's helper to structural engineer. Thus, when Chavez left high school, he drifted into construction and cabinetry. He worked for other people for five years, collecting tools and acquiring a wealth of knowledge by taking apart and repairing old pieces of furniture. Eventually, he set up his own shop.

"I feel strongly about what I'm doing—not because I have a product to offer—but because it's part of the ongoing history of New Mexico," he says. "Having that heritage has come into play—particularly in the last seven or eight years—due to the popularity of Southwest style."

Chavez's designs have evolved from studying historical New Mexico furniture pieces, talking with older people and *being aware* of the hardships they experienced. He tries to picture himself among them, somewhat awed at what they managed to accomplish with what little they had. He knows that quality is timeless and hopes what he does today will become an heirloom tomorrow.

of Southwestern mesas and traditional pueblo housing.

The front legs (B) are simply ripped out of another piece of $\frac{3}{4}$ " and smoothed to finished size on the jointer. Chavez doesn't own a sander. He finishes every piece with hand planes and scrapers.

He bevels all machine-created 90° angles with his chisel so the edges on the finished chair will be soft and smooth.

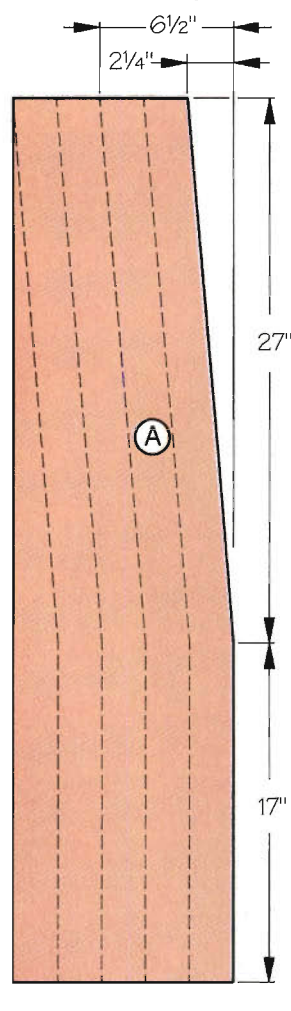
The top rail (C), mid rail (D) and seat rails (E) are all cut out of 1" stock. Before cutting the seat rails to length, the inside of the rails should receive two $\frac{1}{4}" \times \frac{1}{4}"$ grooves running their full length. These grooves match the tongues of the corner blocks that support the seat. Locate the first groove 1" from the top edge and the second $1\frac{1}{2}"$ from the top edge. Also before cutting to length, Chavez relieves the tops and bottoms of the rails with a three-bead moulding cutter on the table saw. The mid rail gets this same beading but must be cut separately because of its different width. He uses the same setup to bead the outside edges of the legs, but with the wooden auxiliary fence shifted over to expose only one bead of the cutter.

Cut the bottom rungs (F) and stretchers (G) from $\frac{3}{4}$ " stock. The Cutting List dimensions for these parts include their tenons.

Making Mortises

Chavez cuts his mortises with a $\frac{1}{2}"$ chisel in a drill press. He mounts his right-angle stop (see the Jig Journal) to the drill press table to establish one end of the mortise. Once that's

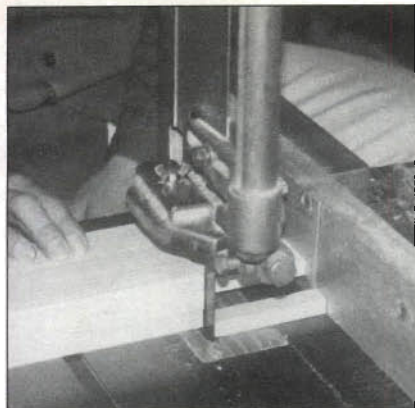
Figure 1. Back and Front Legs



cut, he rests a small L-shaped spacer over the stop to set the location of the other end of the mortise. Then he goes back and cleans out the material in between. He cuts these through-mortises to half depth, flips the leg over and finishes the cut from the opposite side to prevent tear-out.

Cutting Tenons

To get a clean shoulder on his tenons, Chavez first cuts them on the flat side of the rails with a regular blade on the radial arm saw. Then he comes back and removes the rest of the material with a dado blade. Next he sets up a fence and a stop on one of his two band saws, and rips the piece to



Cut the shoulder waste on a band saw.

Clean up the tenons with a chisel and block plane.



establish the width of the tenon. Then he goes to the second band saw to crosscut away the waste. He makes offsetting tenons where the seat rails (E) intersect at the corners as shown in Figure 2 on page 40.

Chavez cleans up any saw marks on the tenons and shoulders with a sharp 1" chisel and small block plane. He dry-fits each tenon to each mortise and marks them with letters so he knows where each will wind up. His tenons stand proud by 1/4", reminiscent of California Mission style. In a detail all his own, he bevels the protruding tip of every through-tenon, as well as the outside edge of every mortise.

Hand Carving

Rope carving is a traditional element seen throughout New Mexico architecture and furniture. Some say it represents the rope on the Franciscan habit; to others it's the colonial way to reproduce the carved stone columns remembered from the churches in Spain.

Chavez starts with the 45° angle on his sliding square and scribes a continuous line from top to bottom around the spindle blank (H). He repeats that pattern with a second line parallel to the first.

He scores the lines with a sharp knife, or a dovetail saw, then chisels down to these stop-cuts from a point between the two lines in a rolling, rounding motion (see photo, page 40). He alternates the pattern on the four spindles so two twist from left to right while the others go from right to left.

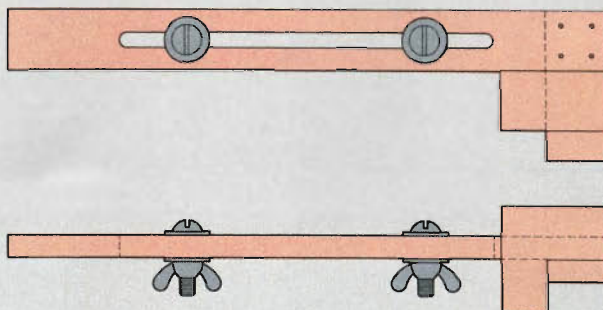
He follows the same method to carve the rosette into the top rail. Trace the outline from a template (see the PullOut™ plans), score the lines, follow the line with a round gouge that fits the contour of the carving, and chisel to the lines.

For a detail that sets his chairs apart from all others, he bandsaws a 1/8" deep line around the foot of each leg at about 1 1/2" from the floor, and chisels from the bottom of the leg up to the line.

Jig Journal



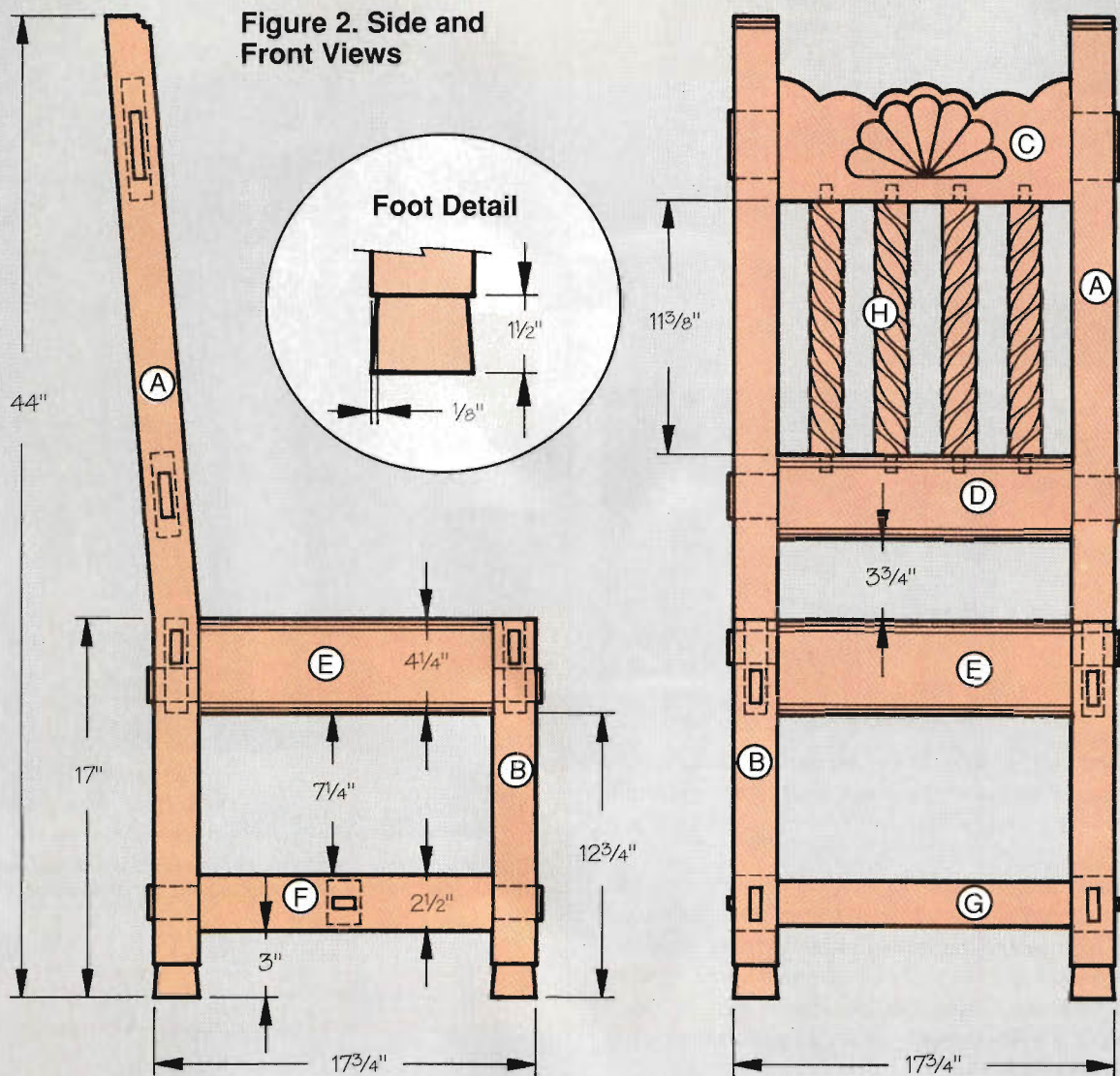
Chavez uses this stop to locate the mortises. A spacer that hangs from the stop sets the second position of each mortise.



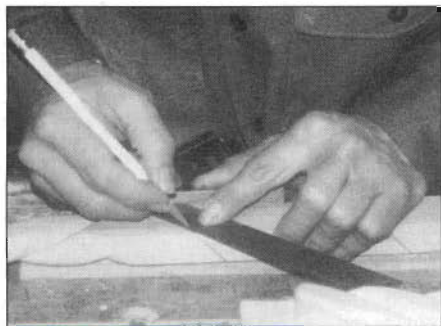
Right Angle Stop

Take a piece of 1" X 2" stock and cut a 1/2" slot down the center to within 4" of each end. Fasten a 3" piece at right angles to one end. Now mount this stop to your drill press table with two 1/2" bolts and wing nuts. Set your chair leg blank centered against the fence beneath the mortise chisel where the first cut will go. Slide the stop out to the end of the leg, and tighten the wing nuts. Set all succeeding chair legs against this stop, and make your first mortise cut on each. To make the second mortise cut, hold an L-shaped spacer between the angle stop and each chair leg. Remove the material in the middle, and each mortise will be of the same length and at the same position on each chair leg.

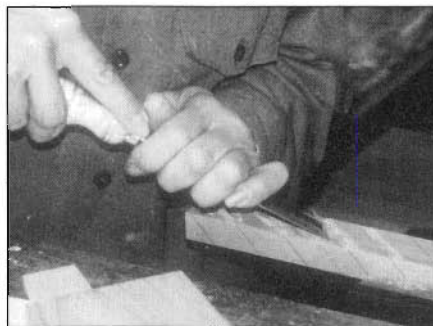
Figure 2. Side and Front Views



Chavez lays out the pattern with a combination square.



Carve down to each line from both directions with a rounding, rolling motion.



Assembly

Chavez uses a little glue on each tenon, and assembles the back legs with rails first, the front legs with rails second, and then puts these two subassemblies together with the side rails last.

Chavez drills a 1/4" hole in the center of each mortise and tenon, rounds the tip of

a piece of cedar (slightly more than 1/4" square stock for a tight fit) in an old pencil sharpener (he likes to use pegs of a harder wood than he used in the chair), bevels the other end with a chisel, and drives it home with a claw hammer. All tenons receive half-blind pegs. The chair back tenons are pegged from the rear of the chair.

High-Back Chair

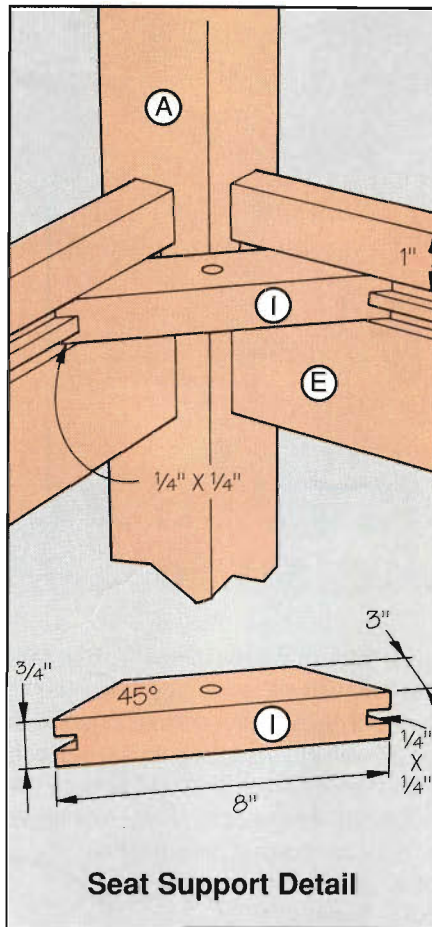
Cutting List

Qty	Part	Finished Size			Piece
		T	W	L	
1	A	2"	6 1/2"	44"	back leg stock
2	B	2"	2"	17"	front legs
1	C	1"	5 1/2"	17 3/4"	top rail
1	D	1"	3 3/4"	17 3/4"	mid rail
4	E	1"	4 1/4"	17 3/4"	seat rails
2	F	2"	2 1/2"	17 3/4"	bottom rungs
1	G	2"	1 1/2"	16 1/4"	stretcher
4	H	1 1/2"	1 1/2"	12 7/8"	spindle blanks
4	I	3/4"	3"	8"	corner blocks
1	J	1 1/4"	17 3/4"	17 3/4"	seat



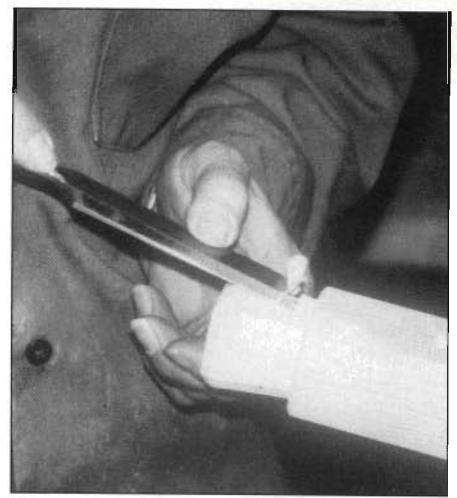
Make the front and back subassemblies; then add the side rails and stretchers.

He fastens corner blocks (I) inside the chair frame about an inch below the surface. Cut the four corner blocks out of $\frac{3}{4}$ " plywood. Miter their ends to 45° and dado each end with a $\frac{1}{4}$ " X $\frac{1}{4}$ " cut down its



Seat Support Detail

center. The seat (J) needs to be notched for the back legs. An alternative to the solid wood seat is an upholstered plywood insert attached to the corner blocks. **PW**



Chavez carves a tapered foot at the bottom of each leg.

The cedar pegs stand a little proud of the finished chair.

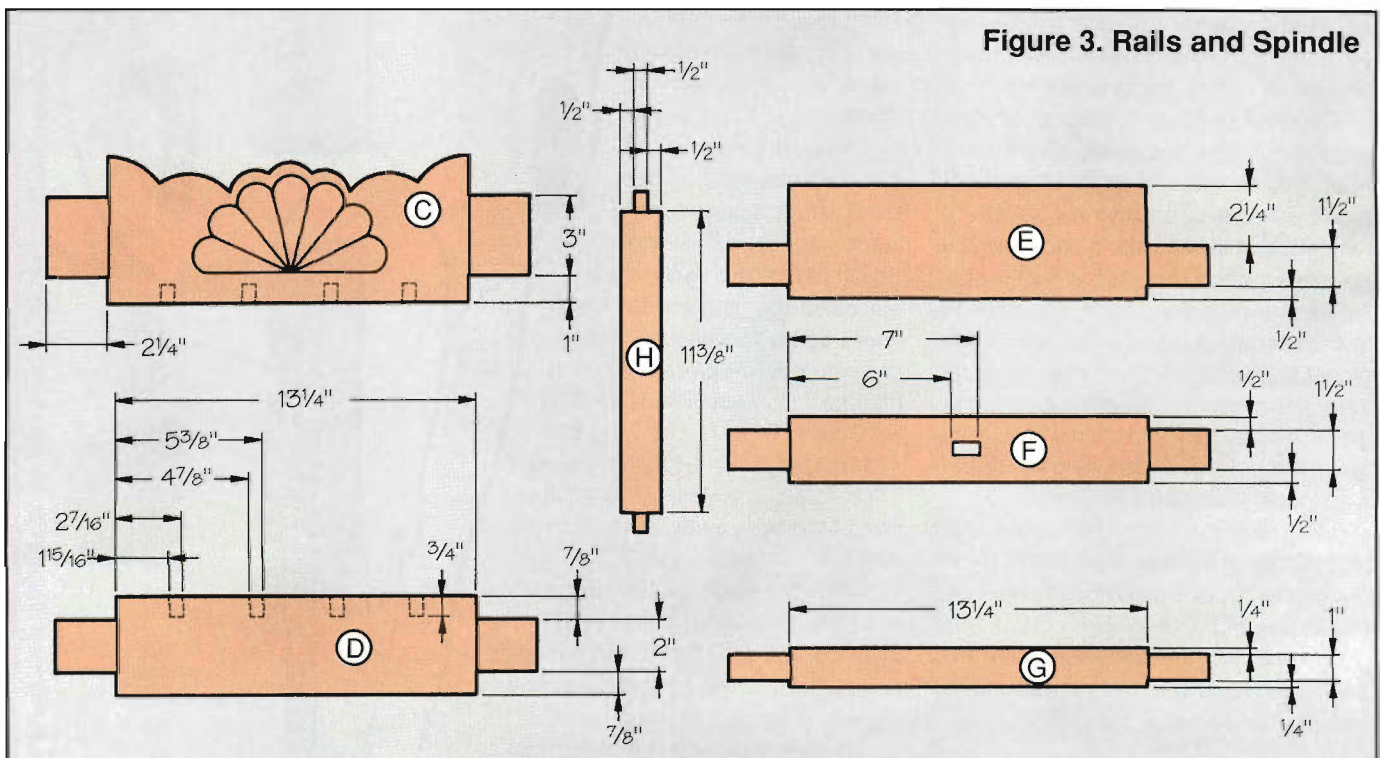
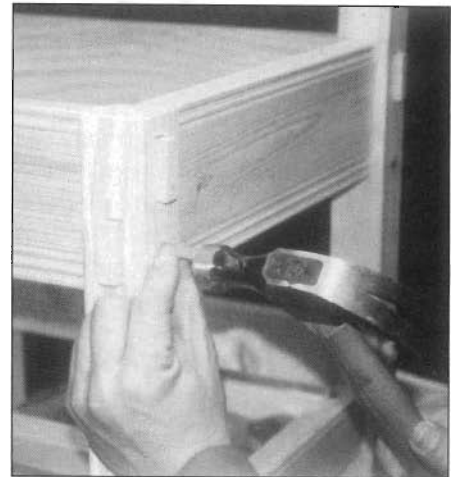
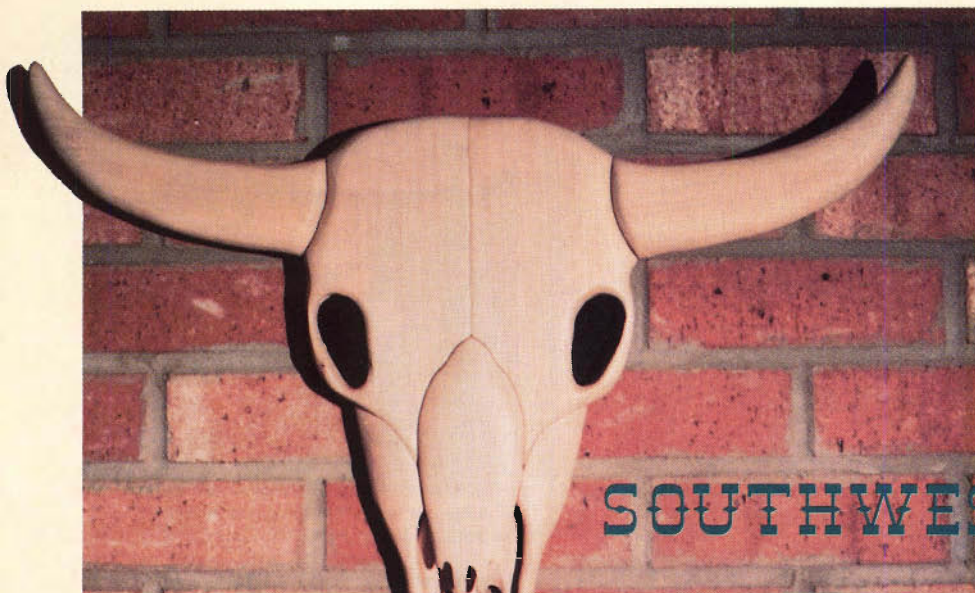


Figure 3. Rails and Spindle



Southwestern Skull Plaque					
Cutting List					
Qty	Part	Finished Size			Piece
		T	W	L	
1	A-C	1"	9"	15"	skull blank
2	D	1"	7"	10"	horns
1	E	3/8"	2 1/2"	4"	nose support
1	F	1/2"	3"	6"	inner jaw
1	G	1/4"	12"	12"	backboard

by Bob Hlavacek

Trace the full-size patterns you'll find in the PullOut™ Plans on 1" thick soft maple or any other light-colored wood. Be sure the grain runs in the long direction. Cut out the skull (but don't cut it apart yet), horns, and the eye sockets in the skull. You can work on a scroll saw, but (except for the eye sockets) a band saw with a 1/16" blade goes much faster.

Set up the router table with a 1/2" round-over bit and rout the front edges of the skull. You can use a drum sander for this, but the router is faster and keeps the dust to a minimum. Rout the front and back edges of the horns, but not the back edge of the end that joins the skull. I did it in three passes for safety and to avoid chipping.

Cut the skull apart. Follow the order and direction of cuts shown on the PullOut™ Plan. You should end up with a nose (A), two foreheads (B) and two jaw pieces (C). On the band saw or with a hand saw, cut down the lower half of the back of the nose (A) as shown in the Figure. Then cut out the nose support (E) from 3/8" plywood and glue it to the back of the nose. Place the inner jaw piece you cut from the skull on the 1/2" maple stock and trace it. Cut out the new inner jaw (F) so it fills the void left after cutting the skull apart.

Mount a 2 1/2" sanding drum with 80-grit paper in the drill press. Start with the outer jaw pieces (C) and sand down to the outer edge, creating a curved contour. Fit the skull pieces together and pencil a line onto each forehead piece (B) where the curved

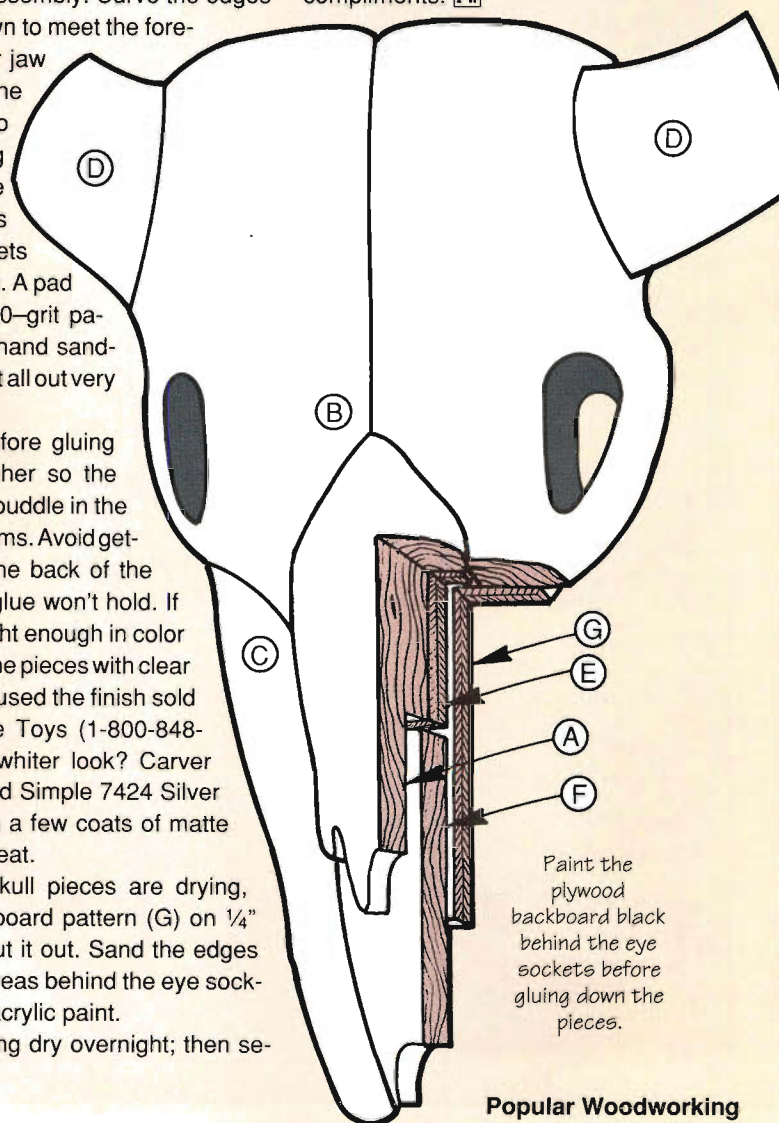
outer edge of the jaw meets it. Then sand the forehead pieces so they flow smoothly into and maintain the contour established by the jaw. When you're satisfied with both sides, pencil a line around the nose and nose support assembly. Curve the edges of the nose down to meet the forehead and outer jaw parts. Sand all the edges down to smooth, flowing curves. Carve down the edges of the eye sockets and jaw cutouts. A pad sander with 120-grit paper and some hand sanding will smooth it all out very nicely.

I stained before gluing the parts together so the finish wouldn't puddle in the cutouts and seams. Avoid getting finish on the back of the pieces, or the glue won't hold. If your wood is light enough in color you can spray the pieces with clear matte acrylic. I used the finish sold by Cherry Tree Toys (1-800-848-4363). Like a whiter look? Carver Tripp's Safe and Simple 7424 Silver Birch stain with a few coats of matte acrylic looks great.

While the skull pieces are drying, trace the backboard pattern (G) on 1/4" plywood and cut it out. Sand the edges and paint the areas behind the eye sockets with black acrylic paint.

Let everything dry overnight; then se-

cure the pieces to the backboard with white glue and nail a sawtooth hanger on the back. Find the right wall, hang the skull—and try to maintain some degree of modesty when you're hit with all those compliments. **PW**



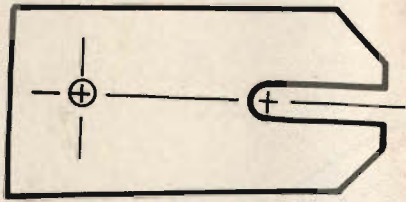
Robert J. Hlavacek, Sr. owns a woodworking business in Berwyn, Illinois.

PullOut™ Plans
Popular Woodworking No. 67
July 1992 (pages 43-58)
Full-Size Patterns

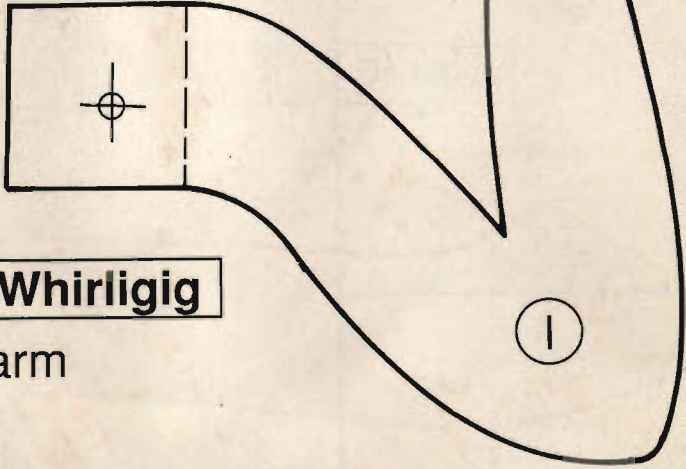


Uncle Sam Whirligig
propeller blades

Ⓔ



Uncle Sam Whirligig
right arm plate



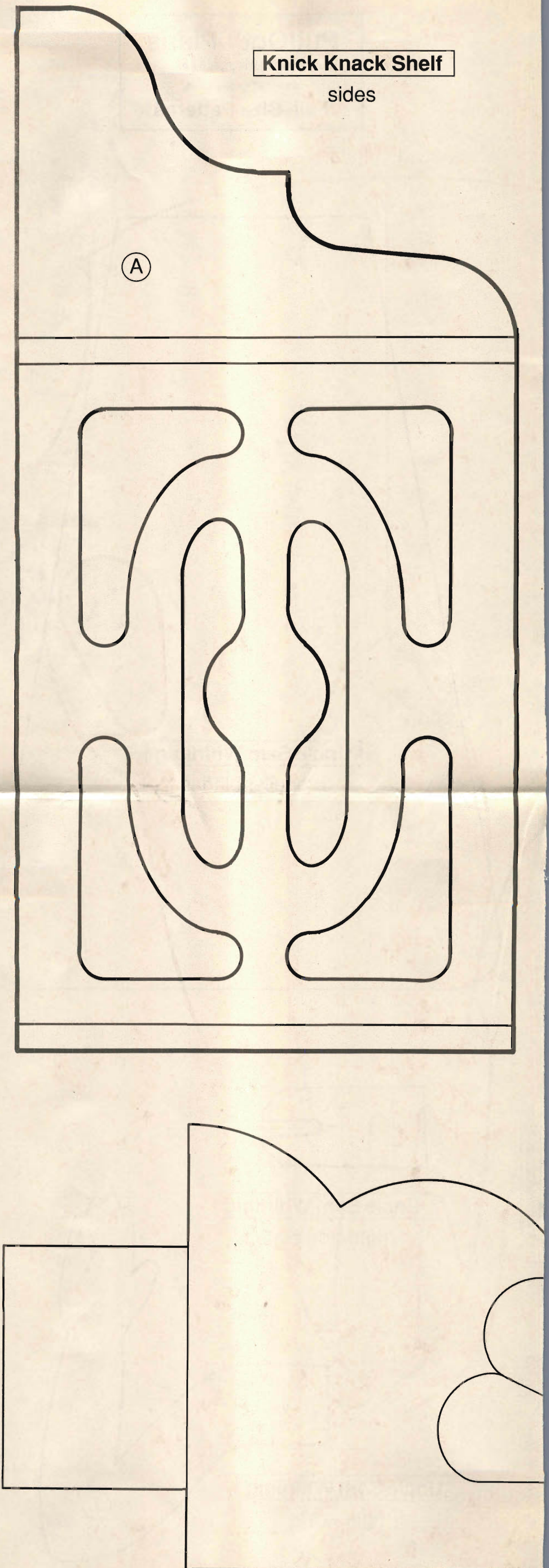
Uncle Sam Whirligig
right arm

Carefully open staples to remove plans, then bend them closed again.

Knick Knack Shelf

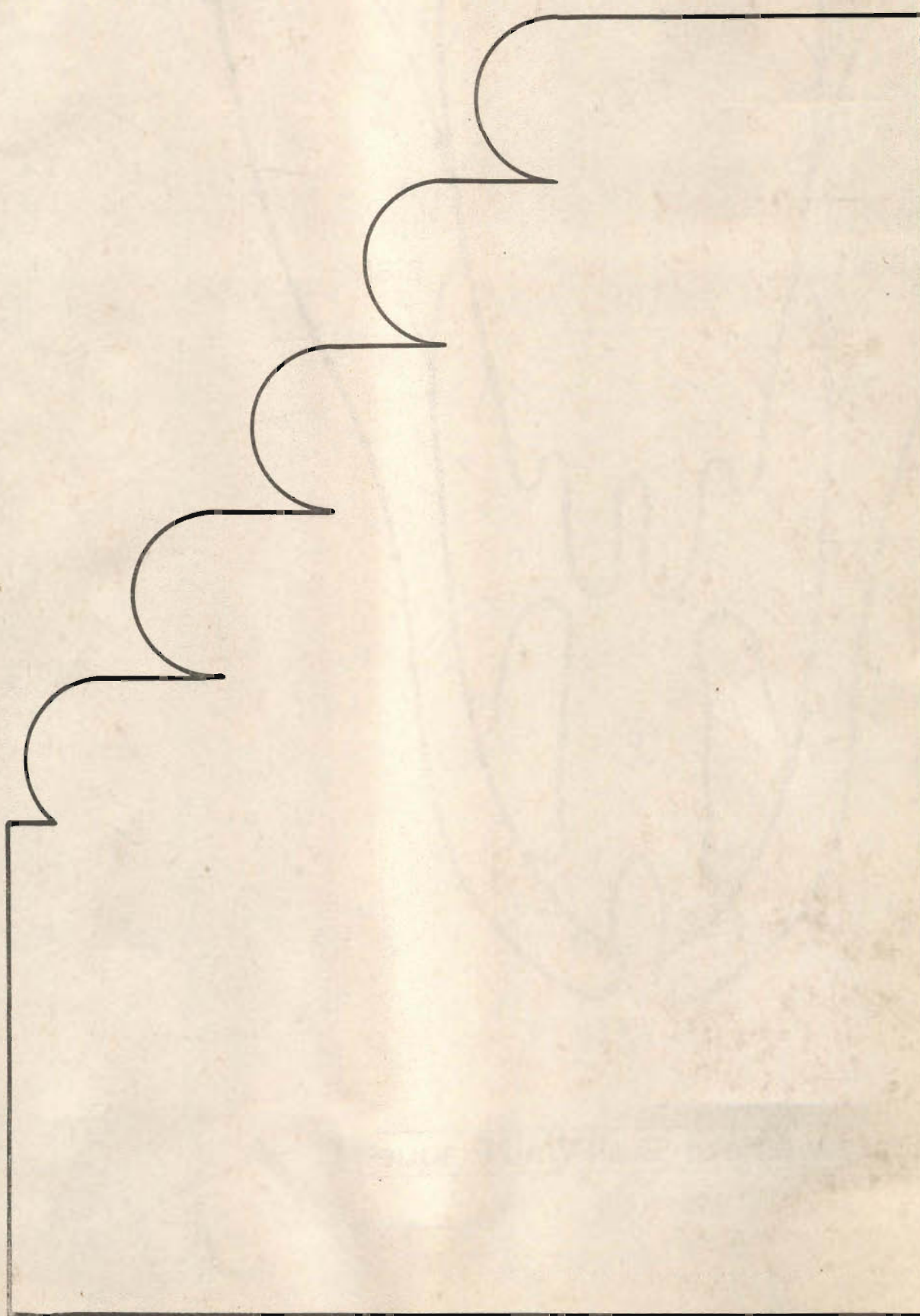
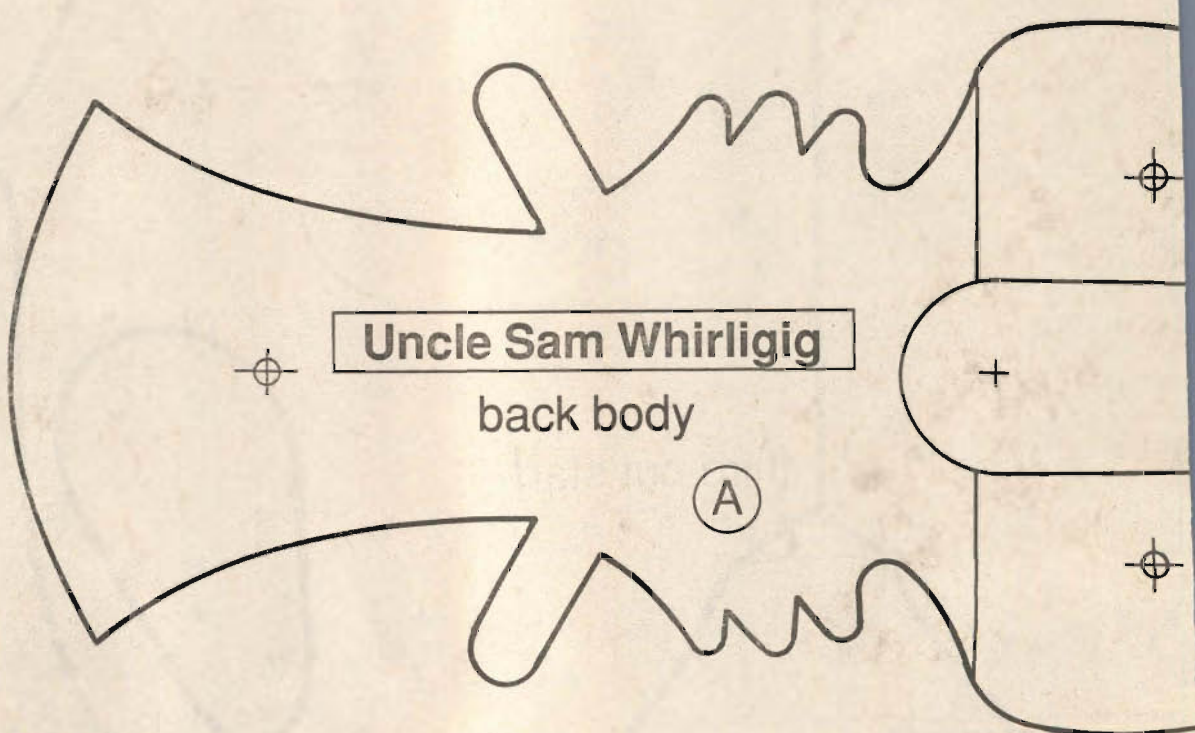
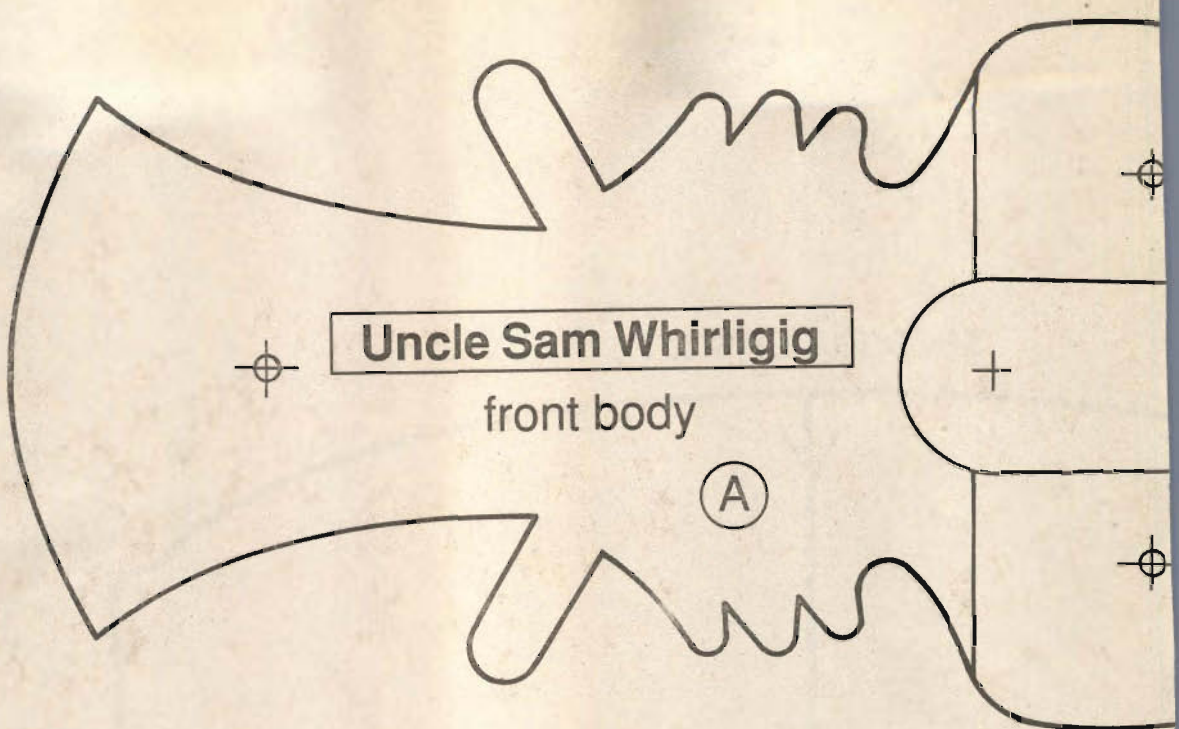
sides

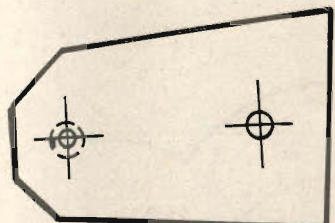
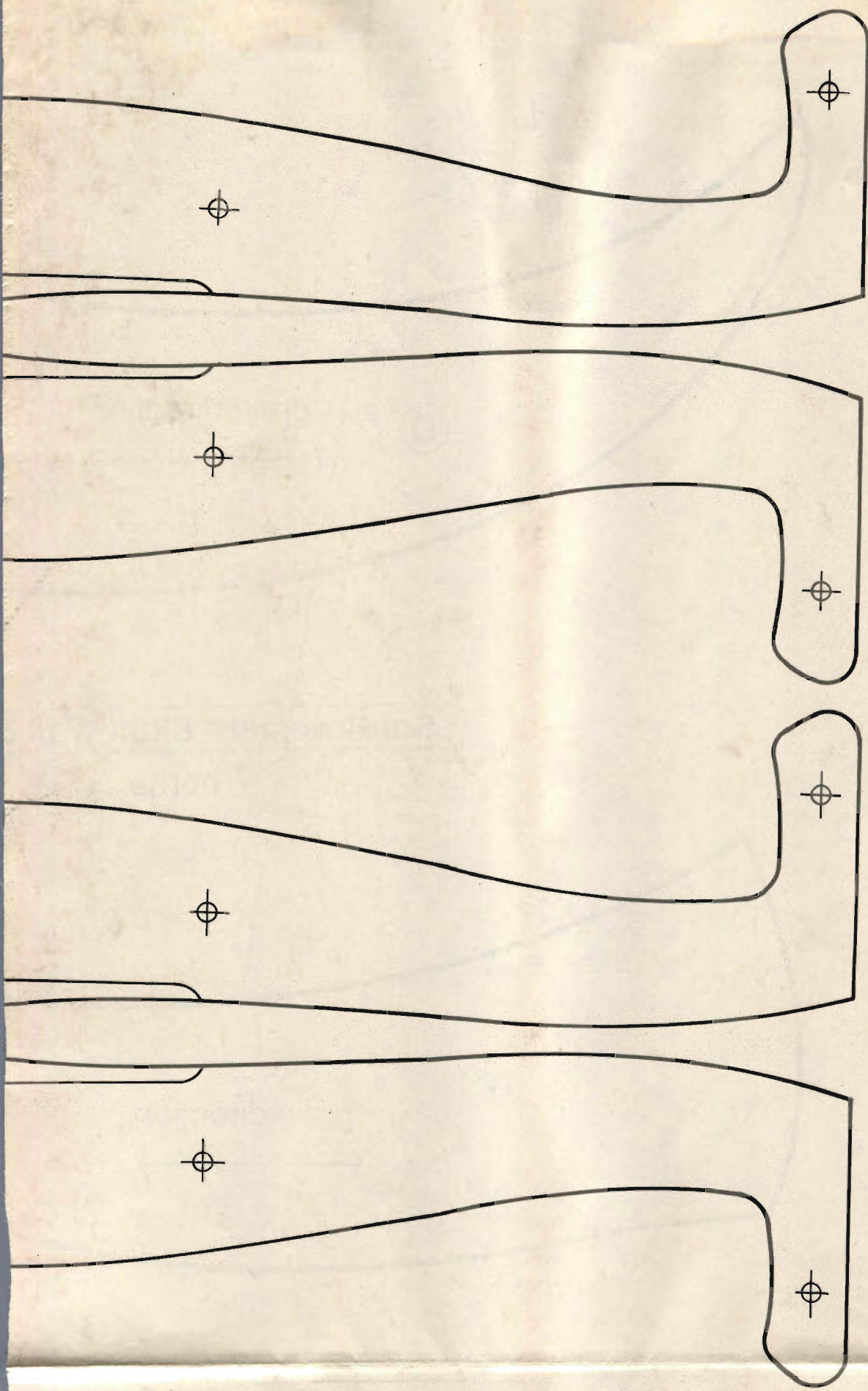
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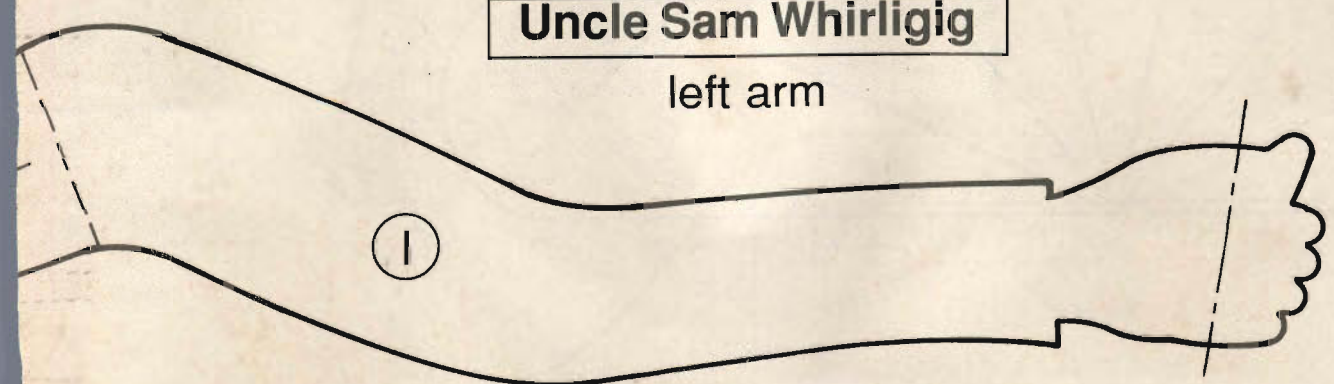
A hand-drawn diagram of a fish's head and jaw structure, oriented vertically. The diagram is divided into three main regions labeled with circled letters: 'A' in the upper central part, 'B' in the upper left, and 'F' in the lower central part. A vertical line with a downward-pointing arrow at the top extends from the top edge of the diagram down to a point labeled 'third cut start'. From this point, two lines curve downwards and outwards, each marked with a downward-pointing arrow. The line on the left is labeled 'fourth cut start' and the line on the right is labeled 'fifth cut start'. Both lines continue downwards, marked with arrows, and then curve inwards to meet at a point labeled 'F'. From 'F', two lines curve outwards and downwards, each marked with a downward-pointing arrow. The line on the left is labeled 'fourth cut start' and the line on the right is labeled 'fifth cut start'. Both lines continue downwards, marked with arrows, and then curve inwards to meet at a point labeled 'F'. From 'F', two lines curve outwards and downwards, each marked with a downward-pointing arrow. The line on the left is labeled 'fourth cut start' and the line on the right is labeled 'fifth cut start'. Both lines continue downwards, marked with arrows, and then curve inwards to meet at a point labeled 'F'. The diagram is drawn on a piece of paper with horizontal fold lines.

Southwestern Skull Wall Plaque

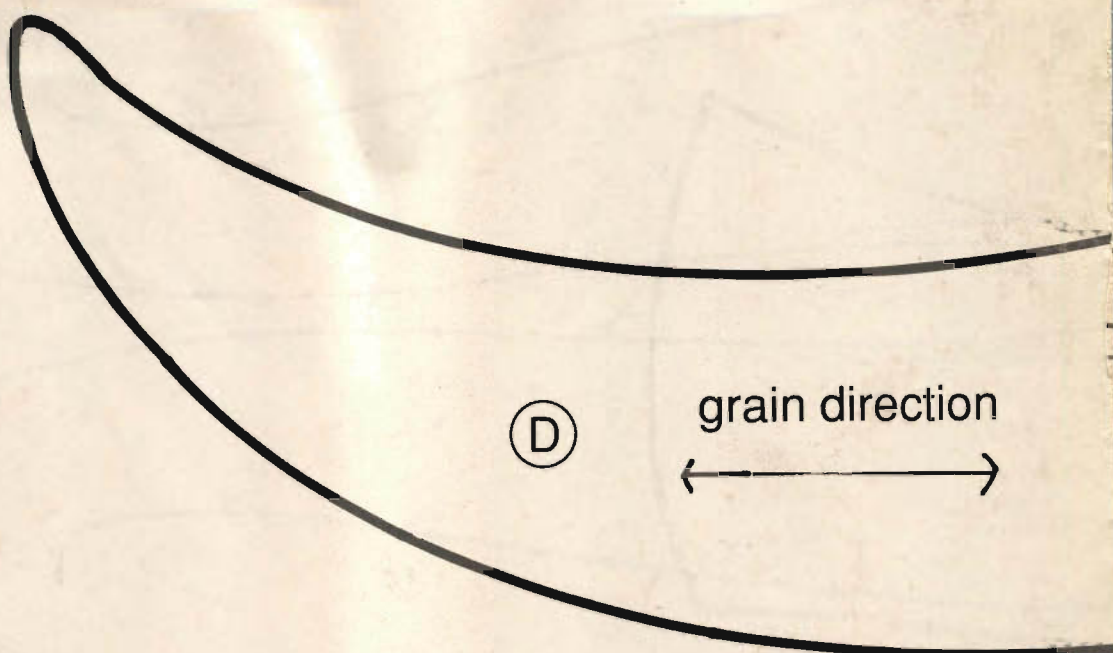




Uncle Sam Whirligig
left arm plate

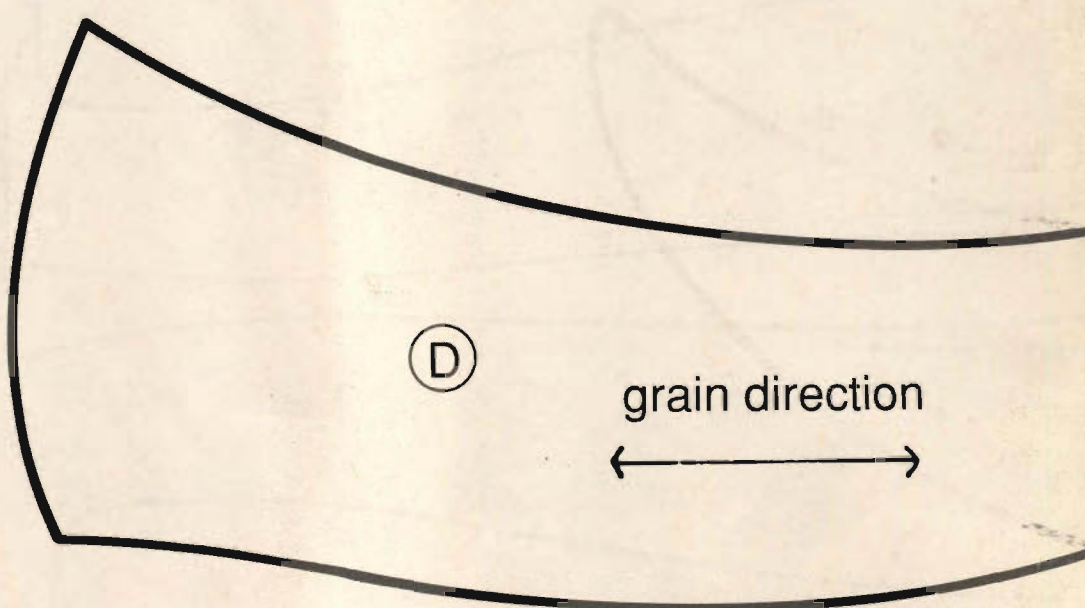


Uncle Sam Whirligig
left arm



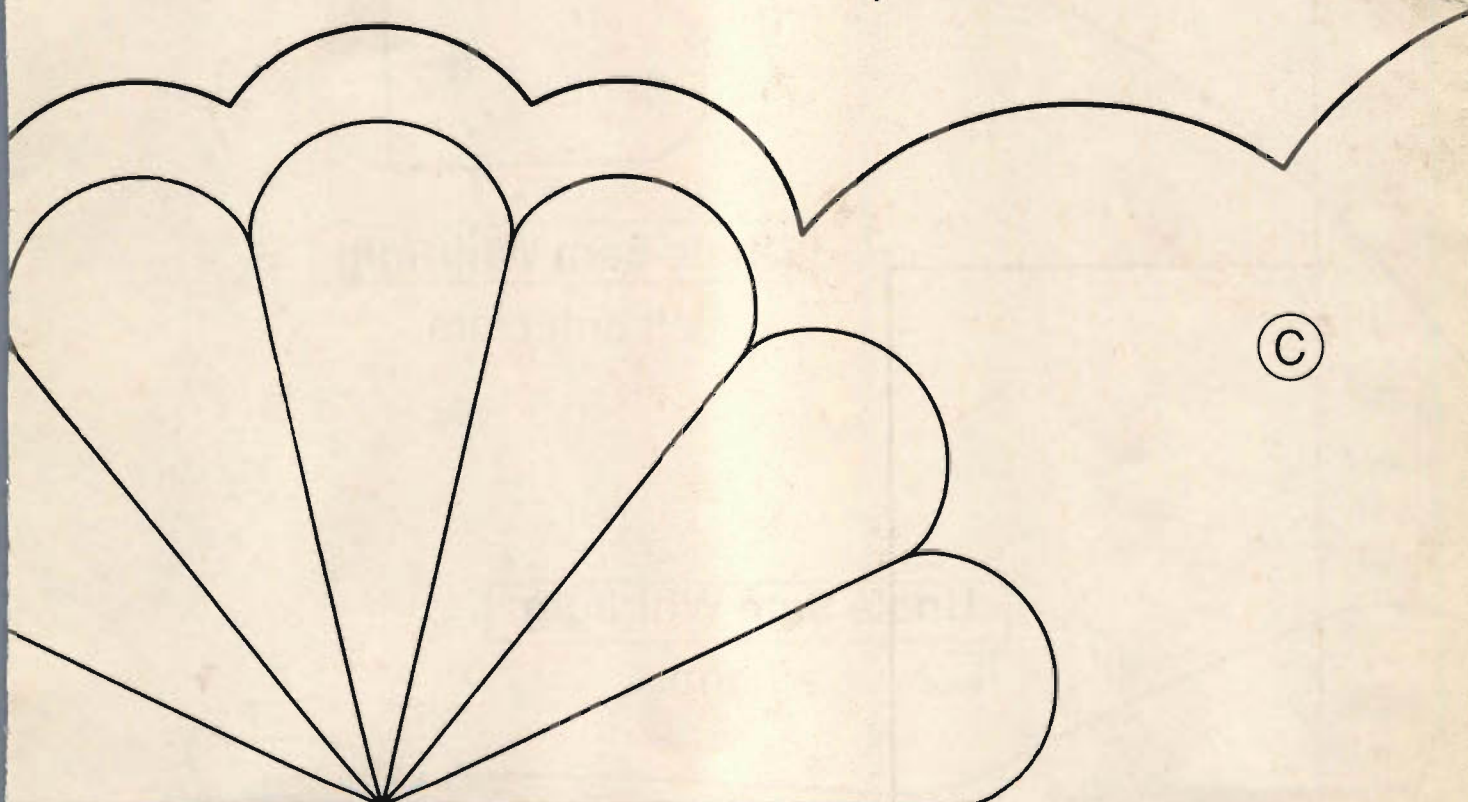
Southwestern Skull Wall F

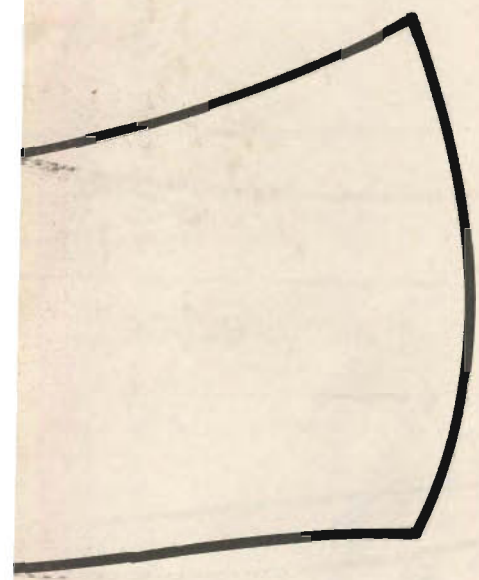
horns



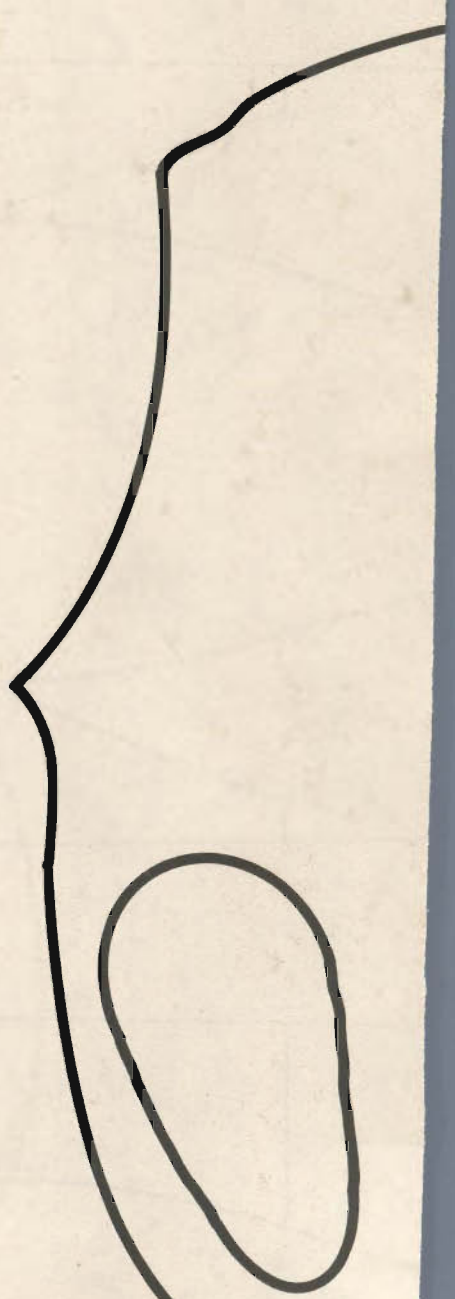
Southwestern High Back Chair

top rail

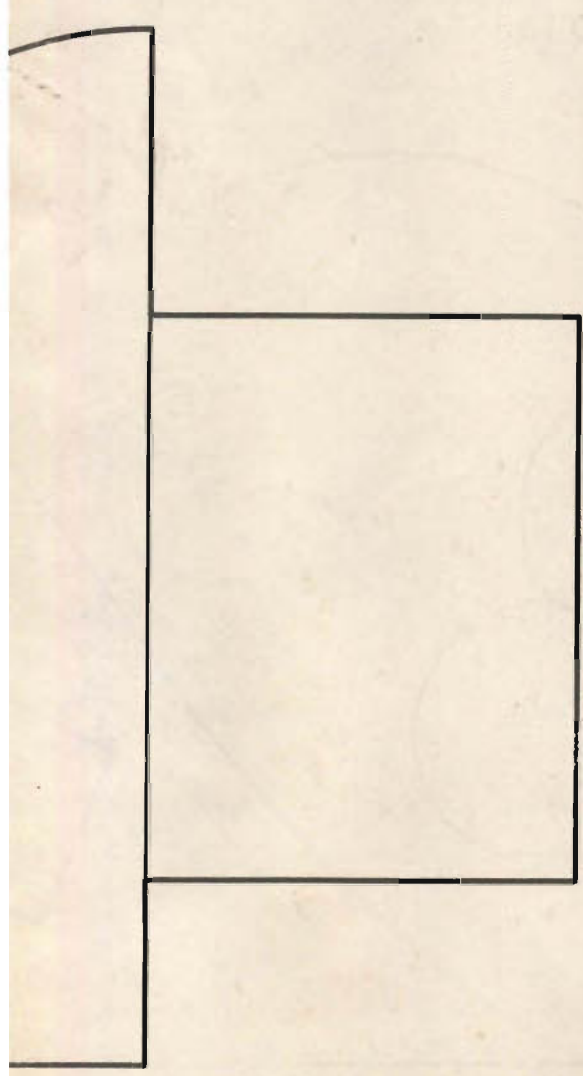


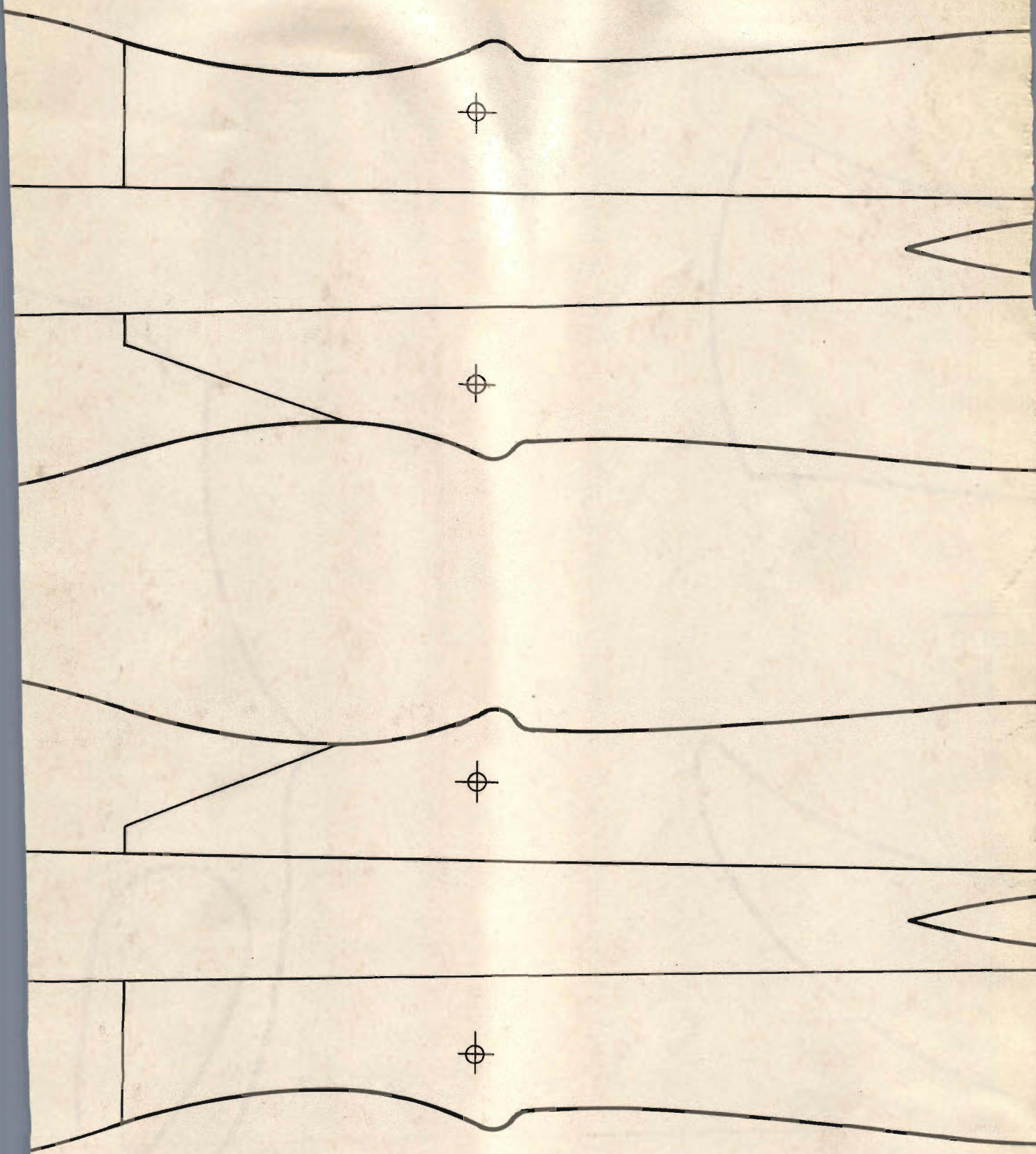


laque



first cut start

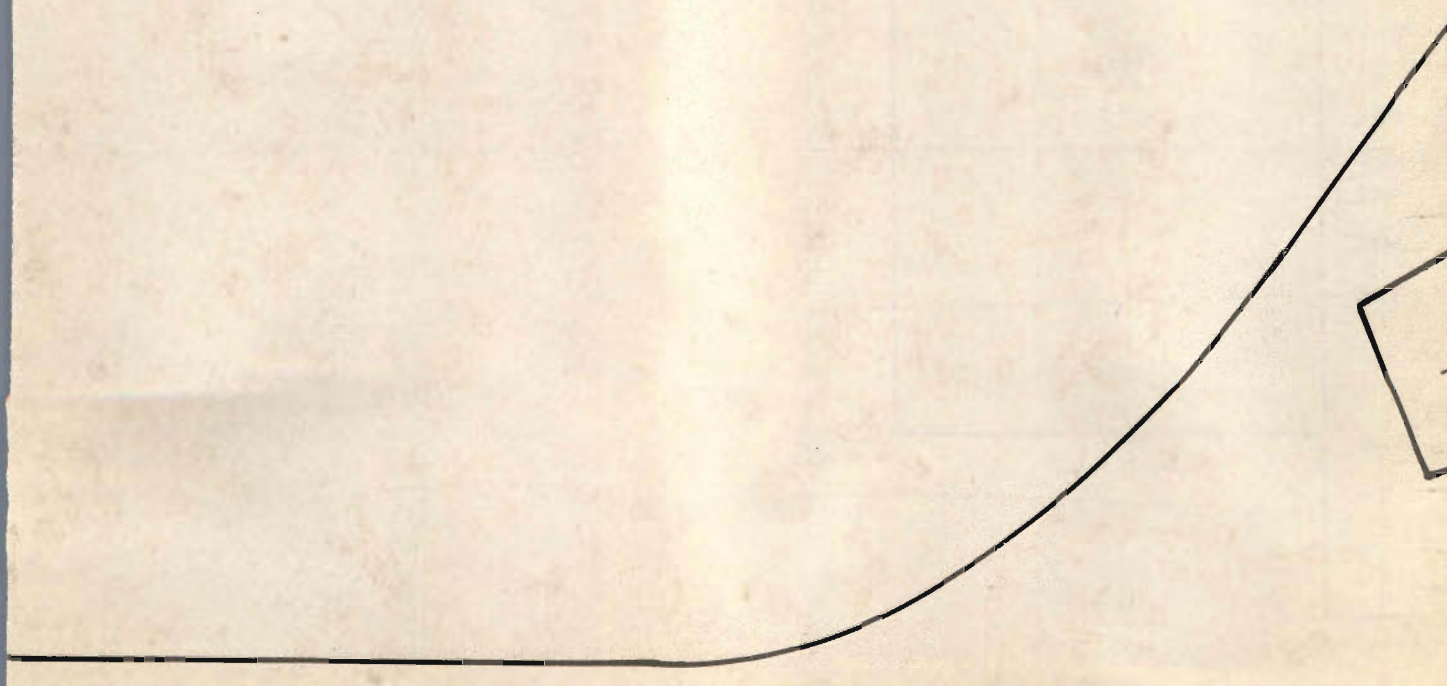




Uncle Sam Whirligig

rudder

©



Uncle Sam Whirligig



by Robert L. Calvert

In the past, all of my projects tended toward the practical, but now I find myself with the time for a little whimsy. My wife and I used to buy a lot of whirligigs, some expensive and some not. They all had one common feature—they eventually fell apart, although a \$6.00 model we bought five years ago still works. They all had wing propellers too, and I wanted something with more animation and durability. I settled on Uncle Sam. I wanted him big, lifting his hat with one hand and waving the flag with the other. But the hat was too heavy for the mechanism. I toyed with the idea of using an American flag for the rudder, but that overpowered the smaller flag in his hand. An eagle and a salute saved the day.

I used standard-sized wood stock wherever possible and designed a six-bladed propeller for looks. The Jig Journal on page 64 details the construction of the special fixture you need to cut the slots for the blades.

I've been a mechanical designer for forty years, so the mechanism to activate the arms may seem overbuilt. I have suggested alternate designs where practical.

Bob Calvert designs and builds practical and fun projects in San Jose, CA

The Body

Start by selecting two pieces of $\frac{3}{4}$ " clear, straight grain pine 5" X 20" long for the body (A). Make sure they're flat—no cupping or twisting. Align the edges and tack them together with a small brad in each corner. Mark the front and back pieces with masking tape. Use the pattern in the PullOut™ Plans to transfer the outline of the body, location of the seven screws and the position of the arm pivot pins to the back of the sandwich. Drill $\frac{5}{32}$ " clearance holes $\frac{3}{4}$ " deep for the screws and counter-sink them so the drywall screw heads will be flush. Install seven $1\frac{1}{4}$ " screws. Drill the two arm pivot holes $1\frac{3}{8}$ " deep with a #31 (.120" dia.) drill. If you don't own a set of numbered bits, buy the four bits you'll need for this project; they're inexpensive. You need the #31 bit for tight fitting pivot pins. Next, drill out these two holes with a $\frac{1}{8}$ " drill $\frac{3}{4}$ " deep. This relieves the back of the pivot pins so the two halves can be easily separated.

Cut out the body on the scroll saw—take care not to cut into the brads. Remove the screws and open the two pieces like a book, then mark the front and back on the insides. Mark the locations of the center channel and the arm slots on both pieces.

Make sure you mark the arm slots correctly on each half. You'll end up with right and left hand parts so that when they're put back together, the longer arm—slot is on the left. This arm holds the flag.

Cut the $\frac{1}{2}$ " deep center groove in both halves with a $\frac{1}{4}$ " straight bit in your router. Reset the router to $\frac{7}{32}$ " deep and cut the arm slots in both halves. Lightly hammer the two $\frac{1}{8}$ " X $1\frac{1}{4}$ " pins into the front body half. I used stainless pins to eliminate any

The two halves of Uncle Sam's body are mirror images. Label each piece before you rout the arm slots.



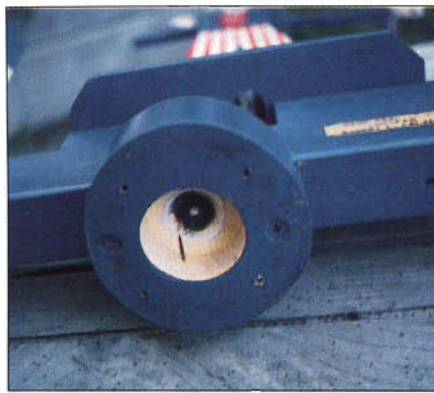
problems with rust. Don't use spring pins (commonly called roll pins) they're oversized and don't make good pivots.

The Base and Rudder

Study carefully for the detailed cutting information on the base (B). The center of gravity (cg) is marked on the plan but may vary depending on your choice of wood, hardware and type of propeller you use. We'll determine its location later.

Cut out the basic shape of the base on your band saw. The dotted lines in Figure 1 represent other parts we'll get to later, but it's important to have the two surfaces where the bearing blocks sit; in alignment so the holes in the blocks line up. Make the dadoed cuts on a radial arm saw. (You may wish to depart from my design on the following.) I used a small instrument gear for the pitman, or propeller crankshaft, on a straight shaft to make it removable from the front. You can use the more conventional bent crank design, but you have to add the slot in the top of the base where indicated in Figure 1. This allows the removal of the shaft and bearing blocks as an assembly through the top. Bore the $\frac{5}{8}$ " hole for the crankshaft.

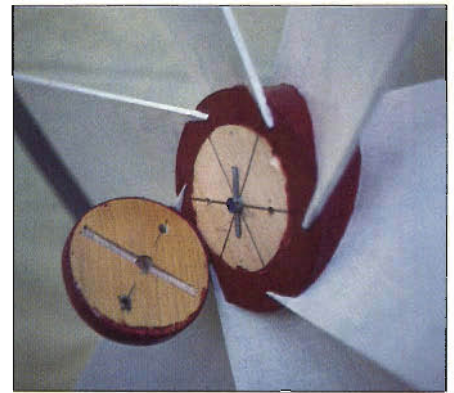
Cut the slot for the rudder (C) $3\frac{1}{2}$ " deep. You may alter the plans and make the cut 3" deep if your table saw blade is too small. Next, make the two hardwood bearing blocks (D). It's important that the bearing holes be in exact alignment with each other. Start with a block of maple 1" X $1\frac{3}{8}$ " X 3" long. Square up the base and ends; then drill a $1\frac{7}{64}$ " hole lengthwise through the center of the block. Cut the block into two pieces and trim to size. Drill two $\frac{3}{16}$ " holes in the blocks and attach them to the base using two #8 X $1\frac{1}{2}$ " RH



Clamp the block securely to the drill press before boring.

(round headed) wood screws. To line up the blocks, slide a $\frac{1}{4}$ " rod through the blocks, and with the screws only finger tight, adjust the blocks until the rod spins freely. Tighten the screws securely and drill two 1" deep pilot holes in each block for the 2" finishing nails. Install the four finishing nails to lock the blocks in place. It's not necessary to have the heads flush, and I left a little sticking up to make disassembly easier if necessary. Drill a small hole in the top center of each block to oil the mechanism.

Copy the eagle from the PullOut™ plans onto a piece of 3-ply $\frac{1}{8}$ " plywood. It's available in 36" X 84" pieces and is sold as door skin, or you can buy 12" X 36" pieces at a model hobby shop. Follow the grain direction shown on the pattern. Cut the eagle out on your scroll saw with a 6" X 6" X $\frac{1}{2}$ " thick piece of scrap beneath the plywood to reduce any splintering. Push the thicker board halfway through the saw and fasten it to the table with some tape around the edges. Now you can saw the thin wood.



The groove in the hub retainer cap for the spring pin connects the shaft to the hub.

Slide the eagle rudder into the base slot up to the dotted line and drill four holes through half of the base and through the rudder to a depth of $1\frac{3}{16}$ ". Remove the rudder from the base and set it aside until final assembly.

Measure your base and make sure it's exactly $1\frac{1}{2}$ " thick. To make the pivot block (E), cut a groove $1\frac{1}{2}$ " X $\frac{3}{8}$ " deep in a $1\frac{1}{2}$ " thick piece of 4 X 4. Draw a $3\frac{3}{4}$ " circle centered on the groove; cut it out on the band saw and sand until it's true. Drill two pilot holes for the drywall screws and bore a $1\frac{3}{4}$ " diameter hole $\frac{7}{8}$ " deep centered in the $3\frac{3}{4}$ " piece. I cut the groove with a dado blade and drilled the hole with a Forstner bit. Don't attach the block to the base yet.

If you are following my design for the crankshaft, make it out of $\frac{1}{4}$ " diameter rod

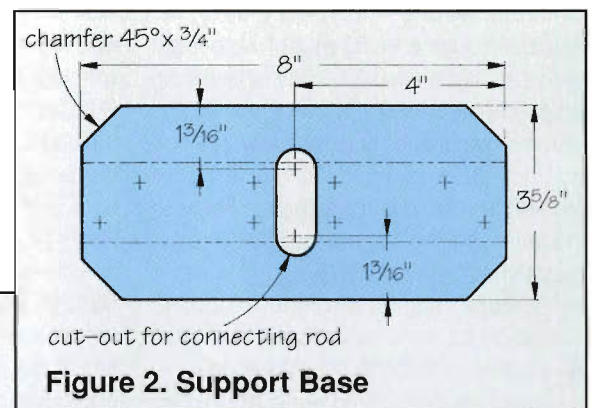


Figure 2. Support Base

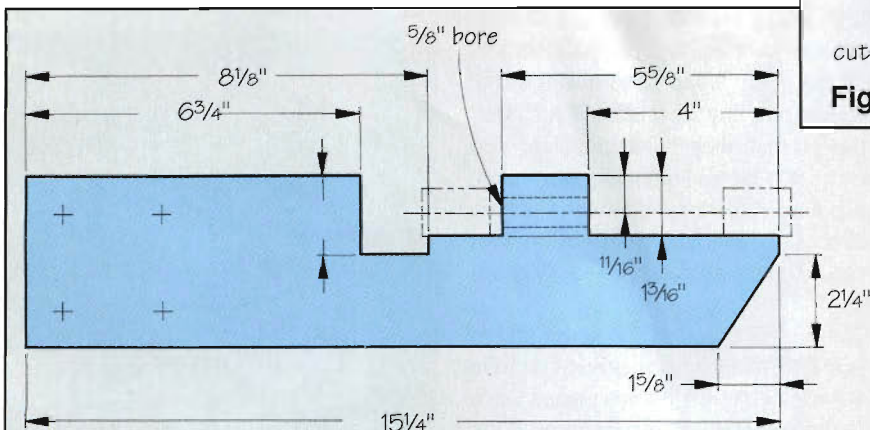
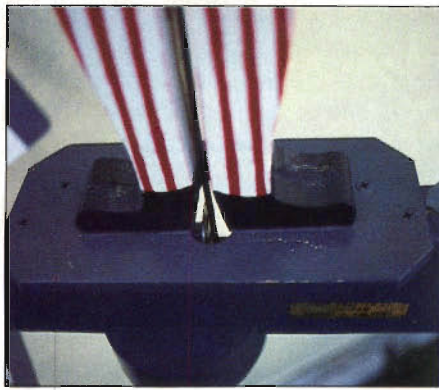


Figure 1. Base

$9\frac{1}{2}$ " long. This is cold-rolled shafting and works best for a rotating shaft. Hot-rolled shafting has a rough finish and can be as much as $\frac{1}{64}$ " oversize—avoid using it. If you elect to use a bent crank design, make sure your crank has no more than a $\frac{1}{2}$ " throw, meaning that the crank scribes a 1" circle when rolled on a flat surface—any more than this and Uncle Sam's hand will jam into his hat. You can bend the cold rolled shafting easily with a propane torch.

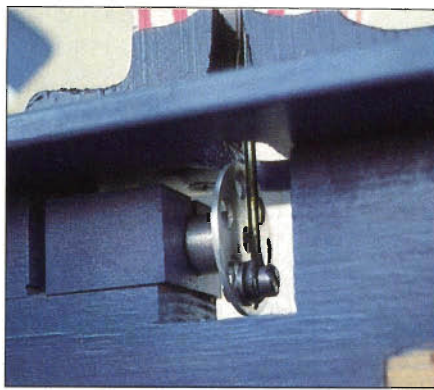


Check the connecting rod clearance through 360° of rotation.

Heat the rod to a cherry red about 2" from the end and bend it 90° with pliers. Heat it again 1/2" closer to the end and bend straight again. Be sure you start with a much longer rod than you need, because unless you are an experienced iron worker it will take you several tries to get the 1/2" throw just right.

Make the hub drive retainer cap (F) out of hardwood as shown in the above photo, and cut out the propeller blades (G)—the grain direction is along the length of the blades. To make all the propeller blades exactly the same, cut them out slightly over size and stack them. Tack them together with a couple of small brads and sand the stack to the line. All the blades are then identical and the prop will be balanced—this especially important if you live in a windy area.

I made the figure support base (H) from 3/8" thick lumber—core birch plywood. If you can't find it, I recommend maple for this as well as the propeller hub cap and the arms. Cut out the piece and the slot for the



The pitman gear can be replaced with a bent rod drive shaft.

connecting rod using the dimensions from Figure 2. Also drill and countersink the screw holes. Note that four of the holes are countersunk from the bottom side; they attach the body to the support base.

The Mechanism and Arms

For the connecting rod, I used the heaviest coat hanger wire I could find—nearly 1/8" thick. Hanger wire is ideal for this part because it's stiff and can take the compression load of the upstroke without bending. To shape it, start with a piece of steel angle at least 16" long, then drill and tap two holes 15 1/8" apart. The size of these tapped holes depends on your design. I used a #10–32 tap because my shoulder screws were 3/16" dia.—the size of a #10 screw. If you used the bent crank design, thread the 1/4" diameter shaft with a 1/4"–20 die and use a 1/4" tap for one of the holes in the angle iron. Use screws that have a smooth

shaft between the threads and the head. Tighten them down all the way to the smooth area. This gives you a smooth area to wrap your wire around without scoring it. Form a loop around one of the pins using pliers. With the first loop nicely formed, bend the wire slightly just on the inside of the second pin and clamp it down to the angle iron with vise-grips. Now form the second loop around the pin and trim it closely. The two loops need to be 90° to each other. Clamp one loop in your vise and the other end in a pair of vise-grips, then pull and twist at the same time. Don't use pins in the loops or you'll pull them out of shape.

I used a small gear for the pitman with a slotted head shoulder screw for the wrist pin. If you made the bent crank version, use a small collar and washers to hold the connecting rod on the crank.

To make the arms (I), trace the arm shapes from the PullOut™ Plans and accurately mark the pivot point. Cut out the arms on the scroll saw. On the salute arm, I cut the hand out separately and made it 1/4" longer at the wrist. Cut a notch in the arm wrist portion. I then rotated the hand



Smooth all rough edges on the metal parts with a fine cut file.

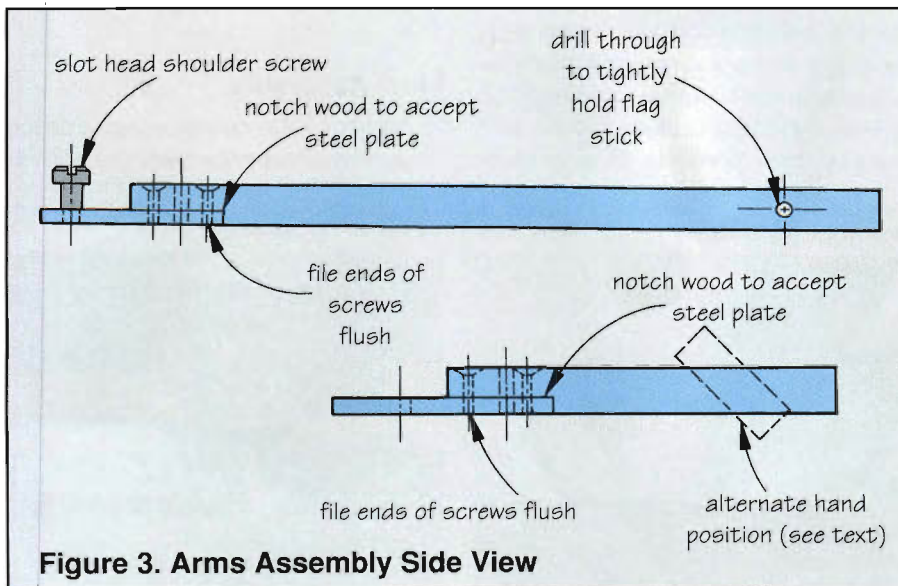


Figure 3. Arms Assembly Side View

about 30° and glued it back on to the arm. This is not necessary, but a flat-handed salute is British, and after all, Uncle Sam is about as American as you can get. Notch both arms 1/8" deep for the steel plate, making sure you have the the correct sides (Figure 3).

With a drill, file and hacksaw, make the two arm plates from an 1/8" thick piece of 1" X 6" cold-rolled steel. Clamp the plates in position on their respective arms and drill through the wood and metal at the same time where indicated. Use a #36 (.106" dia.) drill which is the correct tap drill size for a #6–32 thread. Unclamp the plates, drill out the wood with a #27 (.144" dia.) drill and counter sink for #6 FH machine screws.

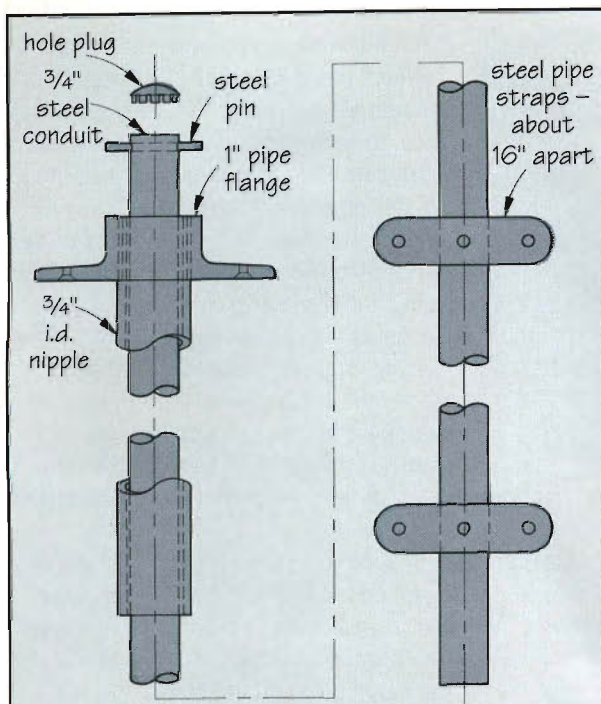


Figure 4. Pivot Mount Assembly

Uncle Sam Whirligig

Cutting List

Qty	Part	Finished Size			Piece
		T	W	L	
2	A	3/4"	5"	20"	body
1	B	1 1/2"	3 1/2"	15 1/4"	base
1	C	1/8"	8 3/4"	21 3/4"	rudder
2	D	1"	1 3/8"	1 3/8"	bearing blocks
1	E	1 1/2"	4"	4"	pivot block
1	F	3/8"	2 1/2"	2 1/2"	hub retainer cap
6	G	1/8"	6 1/4"	9 1/2"	blades
1	H	3/8"	3 5/8"	8"	support base
2	I	3/8"	4 1/2"	7 1/2"	arms

Supplies

2	1/8" diam. X 1 1/4" steel pins
1	1/4" diam. X 9 1/2" propellershaft
1	1/8" diam. X 15 1/8" connecting rod
2	1/8" X 1" X 6" arm plates
1	18" schedule 40 mounting nipple
1	1" steel pipe flange
1	1" snap cover hole plug
1	1 9/16" diam. X 1/4" bore pitman gear
2	shoulder screws (see text)
1	3/4" X 38" steel conduit

Drill a hole through the flag hand to fit the flag staff you have. Drill through the tapped hole on the flag arm plate with a #29 (.136" dia.) drill and tap through. Attach the metal plates to their respective arms and secure with four #6-32 FH machine screws. Use Loctite thread sealant on the screws and file their through ends flush with the plate. Drill through both the wood and metal plate with a 1/8" drill on the pivot point.

The pivot mount assembly is heavy, but sturdy. I suggest buying a 18" nipple (steel pipe with pipe threads on both ends), the threads at the bottom end aren't important. When you select the 1" pipe flange, make sure the

threads are good so that you can thread the pipe into it from the back side. The sheet metal hole plug to cover the hole can be purchased at most electronic supply houses. Some bending of the tabs may be necessary. Use a waterproof glue on all the joints.

Glue the blades into your hub. To prevent the blades from falling out when the glue is wet, clamp a 1/4"-20 threaded rod in a vise with one end extending out so the finished propeller turns freely. Screw a nut onto the rod, followed by a washer, the hub, another washer and a nut. Lock the hub tight with one of the slots pointing up. Slide a blade in, down to the bottom of the slot and centered on the hub. Scribe a light pencil line on the blade where it meets the hub on both sides. Remove the blade, and spread a medium coat of glue on both sides up to the pencil line. Slide the blade

back into the slot and center it on the hub. Do this quickly because the better the fit, the quicker the glue sets up. Wipe off any excess and let things stand for at least 30 minutes. Repeat this procedure for all the remaining blades. The best method is to install opposing blades at the same time.

Assembly

Start by attaching the connecting rod to the pitman gear. If you built the bent shaft version, I used an old aluminum instrument gear for mine, but a stainless gear from PIC (#G3-72) is ideal. Drill and tap two holes—one for the set screw and another for the shoulder screw. This design is the best because it allows you to easily change the throw by tapping other holes in the gear. Apply a small amount of grease on the shoulder diameter of the screw—take care not to get grease on the threads. Slip on the connecting rod, apply a small amount of loctite to the thread and screw tightly into the gear. Attach a locking nut to the back side of the gear.

Next, dry assemble the flag arm with the 1/4" slotted head shoulder screw (#4317 PIC), the connecting rod and the salute arm. The

connecting rod should pivot freely

with the screw tightly sandwiched in between the two plates. If it's not, file or grind a slight bit off the connecting rod's sides. When it fits correctly, assemble the rod arm and screw using grease and loctite. Press the arm pivot pins into the front body half at this time.

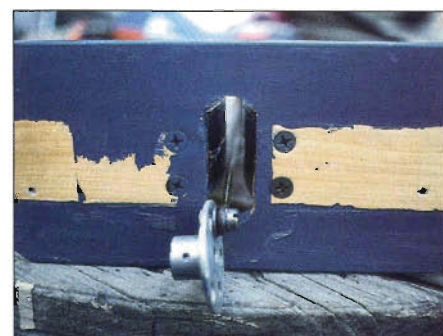
Final Assembly

Spread a light coating of grease on the salute arm plate and the pivot pins. Slip the

The pivot mount assembly is designed to lessen the probability of theft of Uncle Sam.



The pitman gear and connecting rod must be free of any binding.



arm plates together and slide the assembly onto the pivot pins. The flag arm must be on the relief side. Hold the figure up at an angle and work the rod up and down—the arms should move up and down smoothly and *in unison*. If not, you may need to file a bit more clearance into the salute-arm slot. When this is correctly fitted, slide the back body half down over the pins and secure with seven 1/4" drywall screws. Do not use glue between the body halves.

It is important to note which direction the hub of the pitman gear is facing when viewing the back of Uncle Sam. The hub of the gear must face the propeller and the shaft cannot extend beyond the face of the gear. If your hub is facing to the left when viewing Sam's back, disassemble and rotate the connecting rod at the arm pivot joint. Attach the support base to the 2 X 4 base with four drywall screws. Set Sam on the base by slipping the pitman gear down through the base slot. You may need to widen the base slot slightly to do this.

Slide the finished propeller blade shaft assembly through the bearing blocks and onto the gear. The propeller hub's back washer should touch the front bearing block. The pitman gear hub nearly touches the back bearing block and the connecting rod runs up centered between the legs of Uncle Sam. He also needs to be centered and square with the base. Several adjustments may be needed to achieve this—try an extra washer behind the propeller hub or one behind the pitman hub, or you can move Uncle Sam himself. Once you've achieved the correct position, mark around the outside of Sam's feet with a pencil on the base.

Remove the shaft and screws that hold down the support base. While holding the figure within this footprint outline, screw Sam to the support base from the bottom side with four 1 1/4" drywall screws—don't glue this joint. Reattach the support base to the 2 X 4 base without glue, and reattach the propeller shaft assembly. Rotate the shaft so the set screws line up with the flats on the shaft and tighten both set screws. Do not use loctite on the set screws since it makes them difficult to remove and the two set screw design makes it unnecessary. Now spin the blade to check the

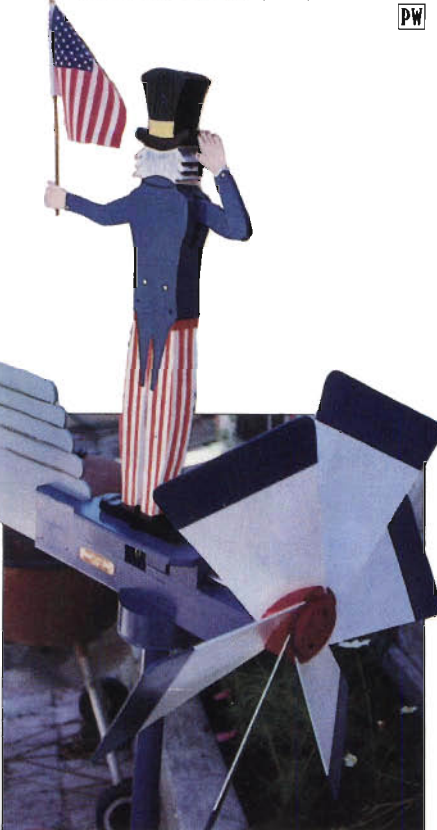
mechanism. Attach the eagle tail with four screws.

Since you may have used different woods or have fewer propeller blades, you need to find the center of gravity. Remove the base from the vise and set it on a knife edge or steel rule so the blades aren't touching anything. Shift the base, which should be perpendicular to the knife edge, one way or the other until it balances. Mark on the base with a pencil at the knife edge—this is your center of gravity. Screw and glue the pivot block at the center of gravity on the 2 X 4 base. Mount the whole assembly onto the inverted pipe flange of the pivot mount assembly with four 1 1/4" drywall screws—avoid the other two screws in the base.

My wife is into crafts and did a superb job of painting Sam. I recommend making some paint samples on the wood you're using and tossing them up on your roof for a few months to evaluate their performance. It's also helpful to read up on bright-colored outdoor wood paints. You can follow the color scheme I've shown or some other combination, but let's face it, he wouldn't be Uncle Sam in anything but red, white and blue.

PIC Design is located at P.O. Box 1004, Benson Road, Middlebury, CT 06762. Their phone number is (800) 243-6125 outside CT, or (203) 758-8272.

PW



Jlg Journal

by Bob Calvert

The propeller hub for the Uncle Sam whirligig needs a special jig for construction. This jig is designed for use on a radial arm saw but could be adapted for a table saw. Its ease of use and accuracy exceeded my expectations.

By changing the dimensions given, you can make any size hub with this jig. This jig will accept up to a 4 1/2" diameter hub.

The base is made from a 16" long piece of 1 X 4. It can be scrap, just so it's not bowed, warped or cupped. For the riser block, I used a scrap piece of 2 X 12 sugar pine milled down to 1 1/2" X 3 1/2" X 4 5/8" for the square edges. Draw a line centered on the 4 5/8" dimension across the 3 1/2" face and continue the line across one edge. This edge is the top of your riser block. Make a 1/4" hole on the center line 2 5/16" up from the bottom.

Mount the riser block on the base. Set the riser block, with the edge center-line up, and the lower right-hand corners of both pieces in line. Twist the riser block 30° to the left and attach it to the base with glue and a couple of drywall screws. The angle is not critical; it can be anywhere from 15° (light winds) to 50° (heavy winds). This determines the pitch on all the blades.

Insert a 1/4" diameter bolt in the hole to

The angle of the riser block on the base determines the pitch of the propeller.



Hub Jig

fasten your hub to the riser with a nut and washer. It's important to have the holes in your riser and hub the same size as the bolt. This maintains concentricity during the indexing and sawing operation.

Next, make your hub blank. I used scrap 2 X 12 sugar pine—it's 3 1/2" in diameter X 1 1/2" thick. For a two bladed propeller, a straight line through the center point will locate the cuts. For 4 blades set your compass at slightly less than 2 1/2" (2.475) and step off the circumference into 4 equal parts. Place the point of the compass on the circumference and swing an arc to cross the circumference in two places. Move the point to one of the arcs and repeat. You can also use a square but this depends on your piece of scrap wood having two edges at a perfect 90°. If you want 3 or 6 blades, leave your compass set at the 1 3/4" radius you drew the circle with, and step off the circumference into 6 equal parts. This works because the radius and the cord length are mathematically equal for a hexagon of any size.

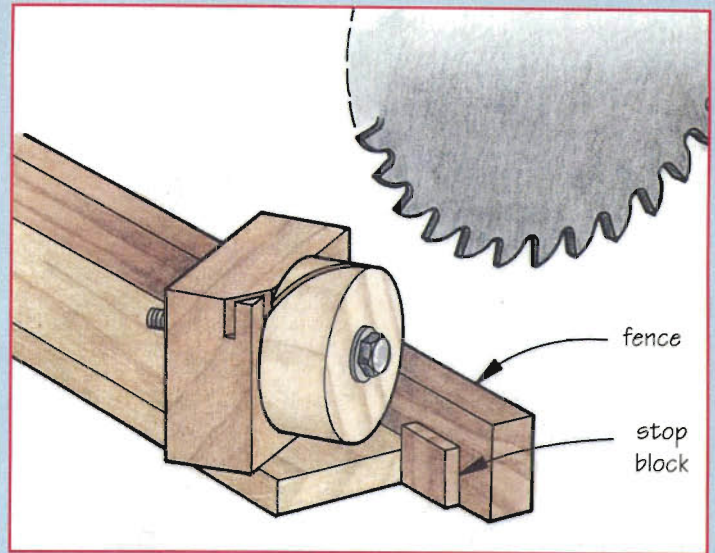
Next, draw the index lines on your hub with a straight edge. Select every other point for a 3-bladed hub, or every point for a 6-bladed propeller. Cut out the hub on a band saw on the outside of the line and

true it up on a sanding disc. You could also turn your hub on the lathe.

Mount the hub on your jig with the index lines facing the riser block. Line up one of the index lines on the hub with the index line on the riser block and tighten the nut or nuts securely. Your fixture is ready.

Determine which saw blade to use for your propeller stock. I used 3/32" thick door skin. Fortunately I had an old, just-sharpened combination blade which made a perfect slot for my material. Ideally, you want the blade to remain in the slot when it's hung up side down, but not so tightly that you have to force-fit it, or the gluing will be difficult. Test the fit with a piece of scrap before you cut the hub.

Now crank your saw head up until it just clears the top of the hub. Position the saw arbor center line directly above the center rod of the hub with the fixture back against the rip fence. Slide the fixture so the blade is centered on the hub. Attach a stop to your rip fence so you can return to the correct position for every cut.



Slide the fixture to the left, just far enough to allow the saw blade to pass down beside the hub. Set the depth of the blade where you want the bottom of your slot—approximately 5/8" above the center line of the hub. This is not very critical, but too deep a cut will weaken the hub.

I found that my combination of propeller material and saw blade thickness required only one pass through the wood. Slide the fixture out of the way before returning the saw blade to the home position. Your set up may require a back cut to achieve the correct fit. This, of course, was determined by your test cut.

Lastly, loosen the hub nut and rotate the hub to the next index line. Re-tighten the nut, move the fixture up against the stops and make your next cut. Continue this process until all slots have been cut.

It is amazing how accurately this simple two-piece fixture will cut a hub. I hope it works as well for you as it has for me.

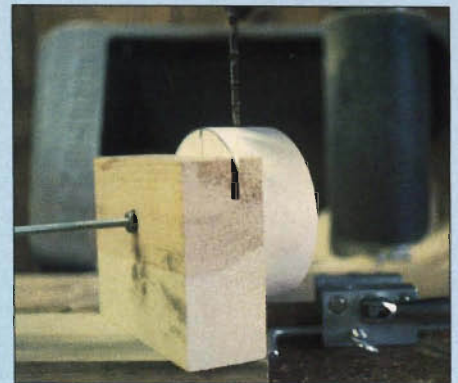
Use a compass to divide your hub into six equal parts.



Position the saw arbor center directly over the center line of the hub.



Use a stop with this jig so that each cut will be referenced off another.



Making Project Plans

by Don Kinnaman

Many craftsmen get project ideas from magazine or catalog photos. The trouble is, once you find a picture of a piece you'd like to build, where do you get the plans? Why not create your own by scaling directly from that advertising photograph? It's quite simple when you follow a few basic rules.

Virtually all furniture manufactured in the U.S. is standardized. For example, most tabletops are 29" to 30" off the floor. Knowing these standards will be helpful when you make your scale drawing and have to guesstimate some of the dimensions. The sidebar below lists many of these standards.

First, make every effort to find the largest photo you can of the piece. A good photo to work with is a three-quarter view that

Don Kinnaman is a retired shop teacher in Phoenix, Arizona.

Furniture Standards— How Big Should It Be?

Years ago, someone came up with a set of standards dealing with the sizes of furniture. It has been very helpful to me through the years in deciding how big to make a basic piece of furniture. For people ranging in size from 5' 3" to 6' 6" (most of us) the following basic dimensions work well:

Bookcases

Space upper shelves 9 1/2" apart, lower shelves not less than 12 1/2", at least 8" deep—10" for oversize books.

Chest of Drawers on Legs

48" high, 36" wide, 18" deep

Lowboy Chests

29" high plus leg length of 7"—total 36", width 36"

Bedside Table

24" to 26" high, 24" wide, 15" deep

Blanket Chests

24" high, 36" long, 18" deep

End Tables

24" high, 12" wide, 30" deep

Coffee Tables

16" to 22" high, 15" to 30" wide, 30" to 48" long

Service Cart

27" high, 16" wide, 27" long

Dining Tables

Allow at least 23" around each person, 20" minimum between table legs. A square top 40" X 40" can seat four; 30" X 60" can seat six. A 44" circular table can seat four; 48" can seat six.

Tabletops in General

28 1/2" to 30" high, 30" to 34" wide

Chair Seats

10 1/2" to 11 1/2" lower than the tabletop height



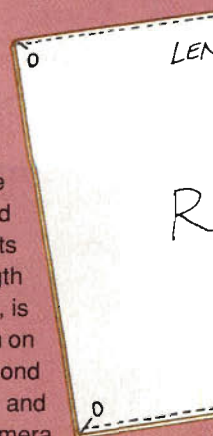
Start with a good three-quarter view photo from an ad or a catalog. The basic dimensions are usually given in the caption.

shows as much of the long dimension as possible. You can build just about any project from a good three-quarter view photo. For this exercise we'll use a photo of a roll-top desk from an old Ethan Allen catalog. Most illustrations in catalogs, newspapers, and magazines give the basic dimensions of length, width, and height in the caption. This is to let people know whether the piece will fit the spot they're looking to fill. These same dimensions are extremely important when determining the scaling for your particular project.

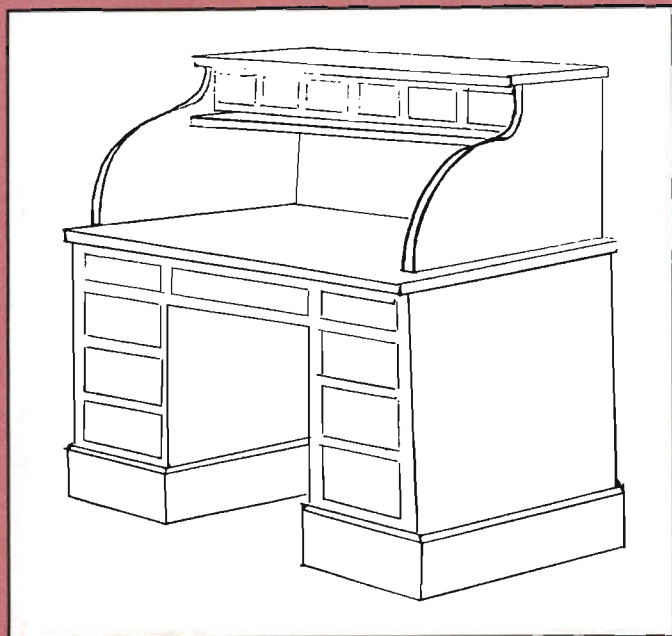
Clip the picture and its caption, and cement the clipping to a piece of plain white paper. Make a line drawing from your photo by using a sheet of carbon or tracing paper, a straight edge, and a sharp pencil. Draw in all of the main dimensional lines, including drawer locations, desk top offsets, and similar parts. Don't copy the minor details; it makes the drawing too cluttered.

Making the Ratio Measuring Tools

Depending on the overall size of the line drawing, you'll need some 4" X 7" or 3" X 5" cards to do the scaling. Use one edge of a card for length, one for width, and another for height. Place one corner of a scaling card at the closest point in the picture, and lay an edge along the longest given dimension (from the caption), and mark the card where the far corner falls along its edge. On my photo of the desk, this is the length along the front, which, according to the caption, is 58". Make a small notation to indicate the length on the card and label this line "length." Use a second corner and edge to do represent the width, and a third for height. Use the corner nearest the camera



From Pictures



Make a tracing from the photo. Show the locations of drawers, etc., and do your scaling from this drawing.

lens (or viewing eye) as the measuring point for the height dimension.

Use graph paper to establish the scale subdivisions; the smaller the squares, the more accurate you'll be. I used paper with 10 squares to the inch. The scale you establish must be physically shorter than the actual "length" marked on the card. Since the length line on my card is $3\frac{3}{8}$ " long, I let each square represent 2"; that makes the scale $2\frac{7}{8}$ " long. Draw a horizontal line on the bottom of the paper and lay out the scale. Draw a vertical line at the scaled length of 58". Lay the card so that the corner is on the "0" mark, and the end point is at the 58" mark on the vertical line. Draw a line along the edge of the card and label this diagonal line length. Do the same for the width and height.

Lay the edge of the card diagonally on the graph paper until the width line falls on the 27" mark on the scale.

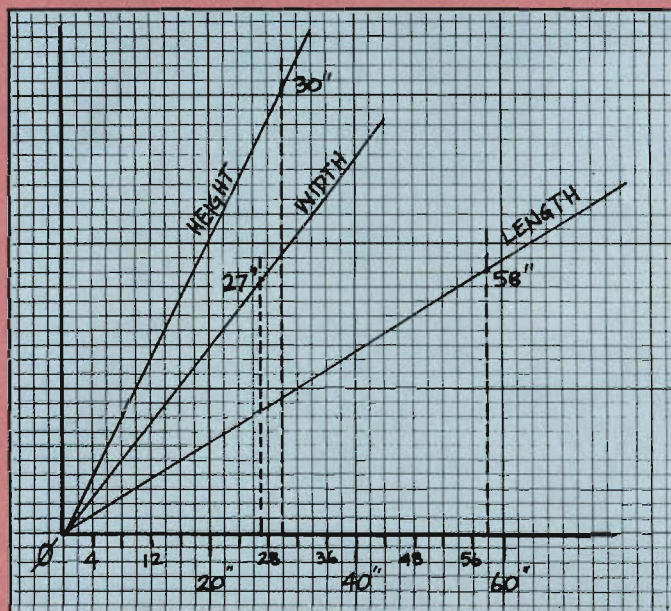
Use this scale you've created to make your scale drawing—your project plans. The length and the height are the most important dimensions in determining drawer locations and other pertinent details. Use your scaling cards to "measure" each section on the line drawing, transfer the locations to the corresponding line on your

graph paper scale, then determine the dimensions you need to make the scale drawing.

If the captions give you odd dimensions, you can change them

to suit your needs. Don't veer too far from the furniture standards, or when you build, your piece may be out of proportion to the original. Don't get confused by a lot of odd fractional sizes; change them to suit your particular needs. When scaling from a photo, see if the design is balanced; are the drawers on either side of the knee hole the same width? In some instances, a part may be too small to accurately determine its size. When you run across a situation like that, you'll have to use your best judgement. The scale drawing you're making is the biggest help; stand back a little, and see if it pleases your eye.

Complete all your measurements carefully. Include approximate dimensions for drawer lengths and sides, runners or slide hardware, and all the other little factors you'll be sure to run across as you make the scaled drawing. After approximating all

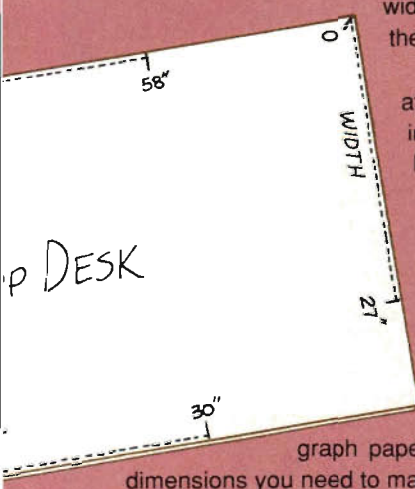


Lay the scaling card edge on your graph paper so that the length marked as 58" falls at 58 on the grid. Find the dimensions of other points along the length by locating them on the grid.

the basic parts, add up the dimensions and see if the sum of the pieces fit the dimension of the whole. Compensate for any miscalculations with small adjustments to the individual sections.

When the drawing is complete, make up a cutting list of all the individual pieces. Do this in sections such as "drawer components," "pedestal frame members," "tambour pieces," "face frames," etc. When the cutting list is complete, draw up a bill of materials to determine the board feet of each selected wood type, square feet of each kind of plywood, and the ancillary parts such as drawer pulls and slides.

This technique can be used successfully on any picture or product advertisement, as long as the photo is relatively large, clear, and doesn't have too many distracting details. With a little ingenuity you can produce plans for some really interesting pieces.



A Popular Woodworking Project



Bruce Richmond

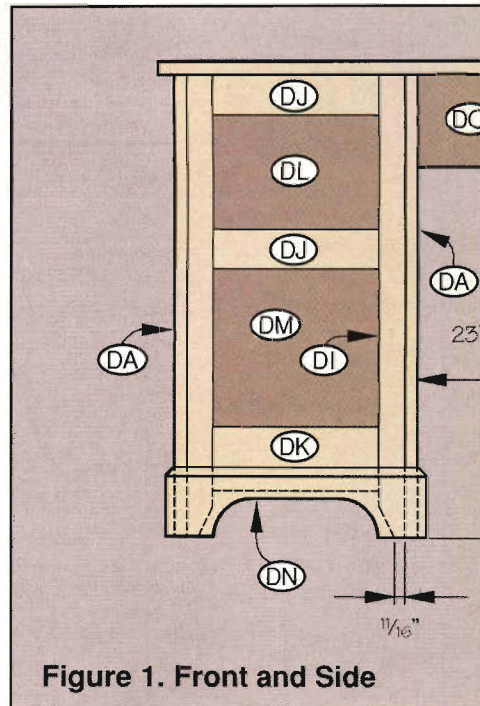


Figure 1. Front and Side

Building A

Part I The Desk

by Robert C. Cook

I really liked the design of the roll top desk in the picture that Don Kinnaman sent with his article, "Making Project Plans From Photos." I went to the Ethan Allen Gallery here in Concord, to see if they had the desk. Steve Fretwell, the owner, was very helpful; but he told me Ethan Allen no longer manufactured this particular style of desk. Perfect! I explained the nature of Don's article about a method of reproducing a piece of furniture from a picture in a catalog. He told me I was welcome to examine any piece of furniture in the store.

In comparing Don's catalog picture to the two models currently offered by Ethan Allen, I found that I really preferred the older design. The accessible drawers on the top (not included on the current models) are aesthetically and functionally pleasing. The desk is large yet delicate in style—and my wife loves it; need I say more?

So I followed Don's directions to scale my plans from his photos. It's a tedious

Rob Cook is an Associate Editor here at Popular Woodworking, and our shop manager.

procedure, but the more detail you process at this point in the project, the easier it'll be to build. Actually, I cheated a little by checking my finished dimensions against the two desks in the store.

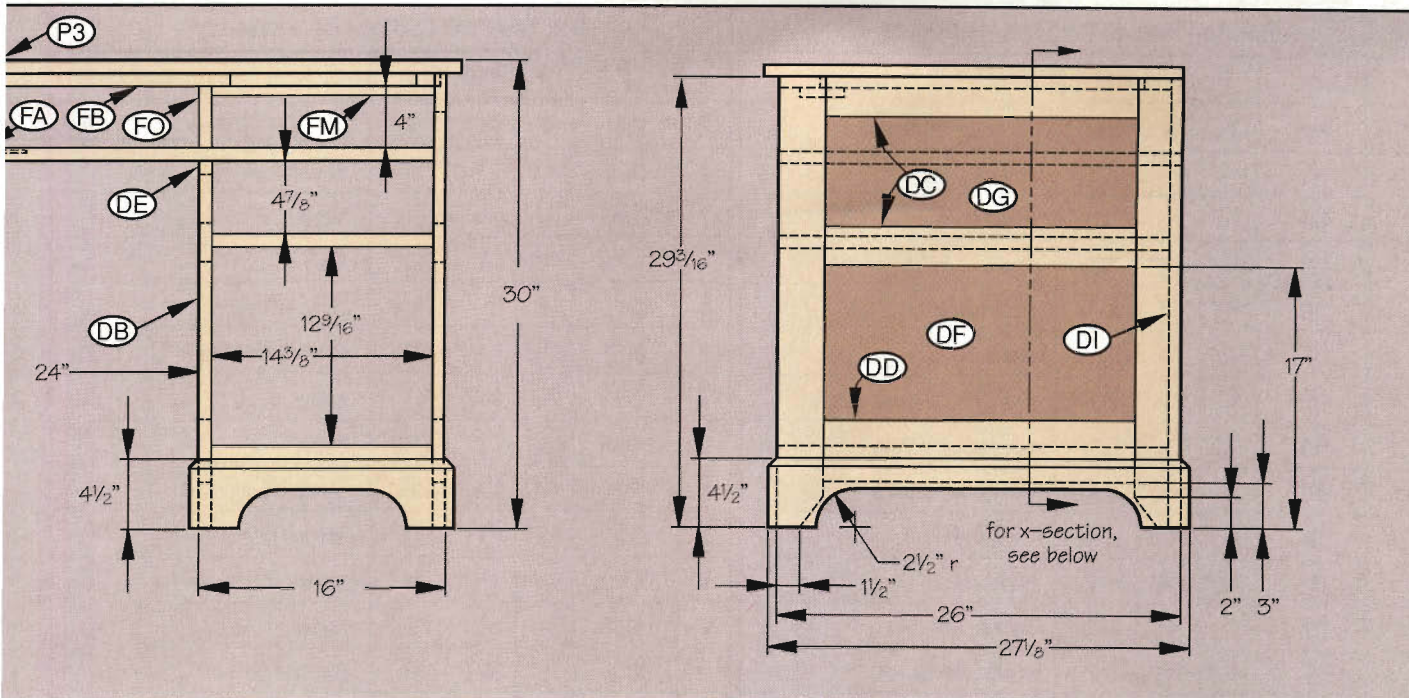
This can be an expensive project, so keep in mind the different wood selections that are available when you make up your shopping list. The selection of woods for your project is a personal decision. Looks—verses—cost is the age-old woodworkers' dilemma. Pine is a nice wood to work with; it's relatively inexpensive and takes a good finish. Yet writing a letter without a pad under the paper will leave a copy in the wood for all to read. A large, dark walnut desk in a poorly lit study may end up being referred to as the black hole (never mind the cost). A combination of woods is a viable alternative. Substitute veneered plywood for the panels, a softwood like fir for the interior frame members, and use alder or poplar for drawer sides and backs. For my roll-top desk, I chose pecan, which belongs to the hickory family and is related to walnut. Pecan is very dense and tough,



has a high crush strength, and stains and finishes well. The price of the lumber was within reason considering the end quality that I wanted (see Wood Types, p. 90).

You can save some money by making the desk without the roll top portion. In this article, we'll give you plans and instructions to get you that far. Our next issue will provide the information you need to continue and complete the rolltop.

Begin by gluing up the large panels for the top, the bread boards, and the twelve inset panels. Label the rough panels P1 through P4 according to the Panel List. All the panels except the desktop have been designed to fit through a 12" planer.



Classic Roll Top Desk

Building the Paneled Sections

Cut the outside and inside stiles (DA and DB) and rails (DC, DD and DE) to the dimensions in the Pedestal Cutting List. Rout the appropriate edges and ends with a stile-and-rail bit. I used a 1/4" shank, reversible stile-and-rail set (Supply List). This bit set cuts a 1/4" X 3/8" deep dado and a delicate ogee in the face. All the stile, rail, and finished panel dimensions given in the Cutting List are sized for this depth of cut. If you use a stile-and-rail set with different dimensions, you'll have to resize the length of all the rails, the length and width of the panels, and change the appropriate di-

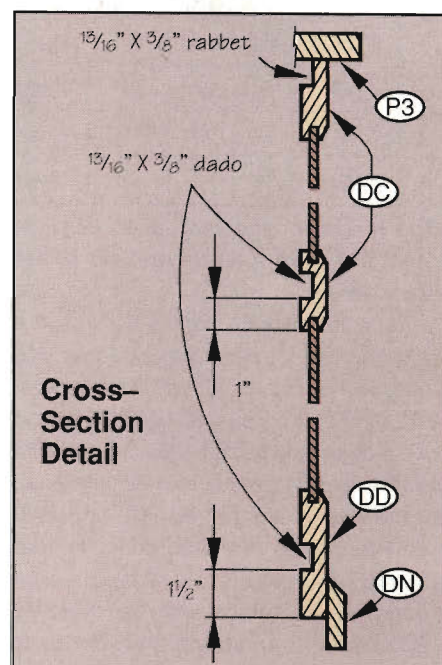
When you mark biscuit locations, keep in mind where you will later cut the panels.



mensions in your Cutting List.

Cut the 13/16" X 3/8" deep dados in the middle and bottom rails (DC and DD), and the rabbet (same size) in the top rails (DC) to accept the frame members. Refer to the cross-section detail to Figure 1. Next, cut and rout the back stiles (DI) and the back rails (DJ and DK) to size.

Trim the bottom ends of the stiles (DA, DB and DI) to the angle that's shown in Figure 2. Locate and cut the slots in the



Panel List

Qty	Part	Rough Size			Piece
		T	W	L	
2	P1	13/16"	12"	67"	six pieces, 22" long
1	P2	13/16"	12"	72"	four pieces, 12" long; one piece, 22" long
1	P3	13/16"	30"	60"	desktop
2	P4	13/16"	12"	24"	breadboards
2	DP1	1/8"	11"	20"	breadboards (dust panels—double-sided hardboard)†
6	DP2	1/8"	11"	21 11/16"	side drawers (dust panels—double-sided hardboard)†
1	DP3	1/8"	20 3/4"	21 11/16"	center drawer (dust panel—double-sided hardboard)†

† Measure rabbetted areas before cutting

Roll Top Desk Cutting List / Pedestals						Roll Top Desk Cutting List / Drawers					
Qty	Part	Finished Size			Piece	Qty	Part	Finished Size			Piece
		T	W	L				T	W	L	
6	DA	13⁄16"	2½"	293⁄16"	outside stiles	1	DDA	13⁄16"	315⁄16"	24"	center drawer
2	DB	13⁄16"	2½"	239⁄16"	inside stiles	2	DDAS	7⁄16"	37⁄8"	21"	sides
6	DC	13⁄16"	2½"	21¾"	rails	1	DDAB	7⁄16"	3"	23½"	back
4	DD	13⁄16"	4"	21¾"	bottom rails	1	DDAP	¼"	203⁄8"	233⁄8"	plywood bottom
2	DE	13⁄16"	1"	21¾"	inside top rails	2	DDB	13⁄16"	315⁄16"	143⁄8"	top side drawers
4	DF	½"	105⁄8"	215⁄8"	inner & outer lower panels	4	DDBS	7⁄16"	35⁄16"	21"	sides
2	DG	½"	7¾"	215⁄8"	outer upper panels	2	DDBB	7⁄16"	3"	137⁄8"	backs
2	DH	½"	37⁄8"	215⁄8"	inner upper panels	2	DDBP	¼"	203⁄8"	13¾"	plywood bottoms
4	DI	13⁄16"	111⁄16"	293⁄16"	back stiles	2	DDC	13⁄16"	413⁄16"	143⁄8"	second side drawers
4	DJ	13⁄16"	2½"	11¾"	back rails	4	DDCS	7⁄16"	4¾"	21"	sides
2	DK	13⁄16"	4"	11¾"	back bottom rails	2	DDCB	7⁄16"	3¾"	137⁄8"	backs
2	DL	13⁄16"	7¾"	11¾"	upper back panels	2	DDCP	¼"	203⁄8"	13¾"	plywood bottoms
2	DM	13⁄16"	10¾"	11¾"	lower back panels	4	DDD	13⁄16"	57⁄8"	143⁄8"	double drawers
2	DN	9⁄16"	4½"	96"	skirt material	2	DDDJ	½"	2¼"	143⁄8"	face-joiners
1	DO	13⁄16"	5¾"	24"	center back	4	DDDS	7⁄16"	1113⁄16"	21"	sides
2	DP	¾"	12"	21½"	breadboards	2	DDDB	7⁄16"	1113⁄16"	137⁄8"	backs
4	DQ	¾"	1¼"	12"	breadboard ends	2	DDDP	¼"	203⁄8"	13¾"	plywood bottoms

edge of two of the rear stiles (DA) as shown in Figure 2. Label and set all the pieces aside.

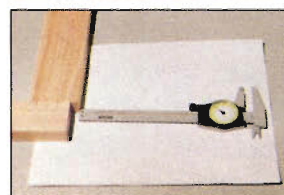
Plane the two P1 panels and P2 to a thickness of 1/2". Alternate sides as you plane, so the biscuits remain in the middle. Next, refer to the Pedestal Cutting List and cut the desk side panels (DF, DG and DH) from the two P1 panels and P2. Likewise, cut the desk back panels (DL and DM) from P2. Set up the dado cutter in your table saw, and cut a 7/16" X 1/4" deep rabbet around the perimeter of each panel. Now's a good time to sand and stain the desk panels. See the sidebar on page 75 for the finishing technique I used.

Assemble the four pedestal sides and two pedestal backs. To do this, attach a half sheet of 3/4" particle board to the top of your workbench and screw two 1 X 2 X 12" plywood strips perpendicular to each other at one of the corners. These keep the frame-and-panel sub assemblies square as you put them together.

Make a dry-assembly first to check for fit. Refer to Figures 1 and 2 as you assemble each component. Slip the piece apart and apply glue only at the junctions of the stiles and rails; try not to get any on the panels. Lightly clamp the pieces, and



Use a drill press or doweling jig to align all the holes.



Inexpensive calipers ensure accuracy.



With the frame clamped, pre-drill and set all the screws.

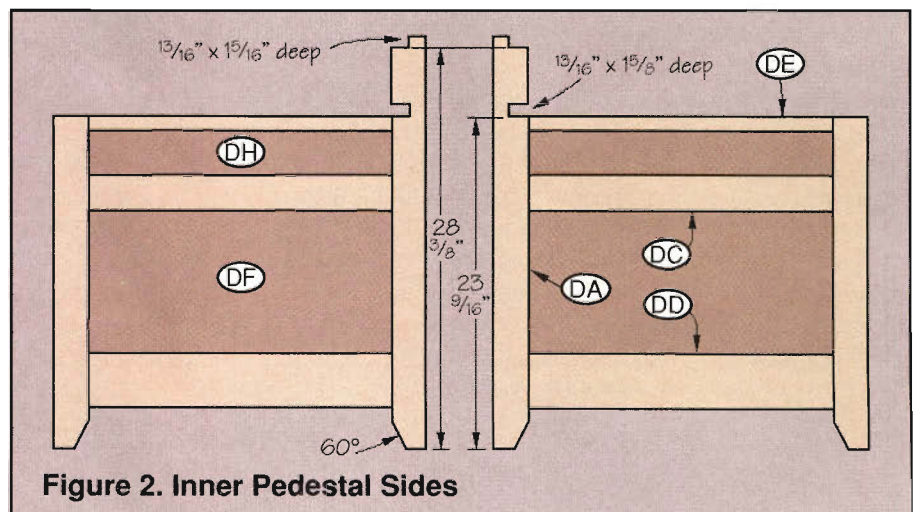
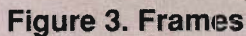


Figure 2. Inner Pedestal Sides

check for square. The two outer pedestal sides are identical as are the two backs, but the inner pedestal sides have a left and a right side as determined by the position of notched stile (DA). See Figure 2.

Frames

Refer to Figures 3 and 5 (next page) and the Cutting List to cut and assemble the desk frame members. Most of the parts that make up the desk frame are too nar-



Supplies		
Qty	Part	Source
1	815-534 desk drawer lock	Woodworkers Supply of New Mexico
1	815-583 escutcheon	Woodworkers Supply of New Mexico
5	24877 dovetailed drawer slides	The Woodworkers Store
10	35402 bail pulls (large)	The Woodworkers Store
4	36038 bail pulls (small)	The Woodworkers Store
2	35451 brass knobs (breadboards)	The Woodworkers Store
2	804-304 Delta drawer slides	Woodworkers Supply of New Mexico
4	¼" X 13⅞" smooth steel rod	local hardware store

When the assembly is dry, remove the frame clamps except for the ones holding the breadboard supports in place. Lay the breadboard slides (FN) in place (Figure 3) and attach them with glue and #6 X 1" screws. Unclamp and remove the breadboard supports, apply glue, and re-clamp. Attach them with #6 X 1 1/4" screws (photo, page 70). Pre-drill and counterbore each hole. If you're using a dense hardwood as I did, put a little soap on the threads of each screw lest you accidentally twist their little

Roll Top Desk Cutting List / Frames					
Qty	Part	Finished Size			Piece
		T	W	L	
Desk and Drawer Frame					
1	FA	13 ¹ / ₁₆ "	2 ¹ / ₂ "	54 ³ / ₈ "	front long rail
1	FB	13 ¹ / ₁₆ "	2 ¹ / ₂ "	28"	front top rail
2	FC	13 ¹ / ₁₆ "	2 ¹ / ₂ "	13 ¹ / ₁₆ "	top rail ends
2	FD	13 ¹ / ₁₆ "	19 ¹ / ₁₆ "	21"	top side rails
2	FE	13 ¹ / ₁₆ "	2 ¹ / ₂ "	21"	top center rails
2	FF	13 ¹ / ₁₆ "	11 ¹ / ₁₆ "	54 ³ / ₈ "	rear long rails
2	FG	13 ¹ / ₁₆ "	2"	21"	bottom side rails
2	FH	13 ¹ / ₁₆ "	4 ³ / ₄ "	21"	bottom center rails
8	FI	13 ¹ / ₁₆ "	2 ³ / ₈ "	21"	drawer sides
4	FJ	13 ¹ / ₁₆ "	2 ¹ / ₂ "	14 ³ / ₈ "	front short rails
4	FK	13 ¹ / ₁₆ "	11 ¹ / ₁₆ "	14 ³ / ₈ "	back short rails
2	FL	13 ¹ / ₁₆ "	1 ¹ / ₂ "	14 ³ / ₈ "	skirt nailer
2	FM	5 ⁵ / ₈ "	3"	14 ³ / ₈ "	breadboard supports
4	FN	5 ¹ / ₁₆ "	2"	21"	breadboard slides
2	FO	13 ¹ / ₁₆ "	2 ¹ / ₂ "	4"	frame stiles
1	FP	1 ¹ / ₂ "	1 ¹ / ₂ "	21"	dust panel support

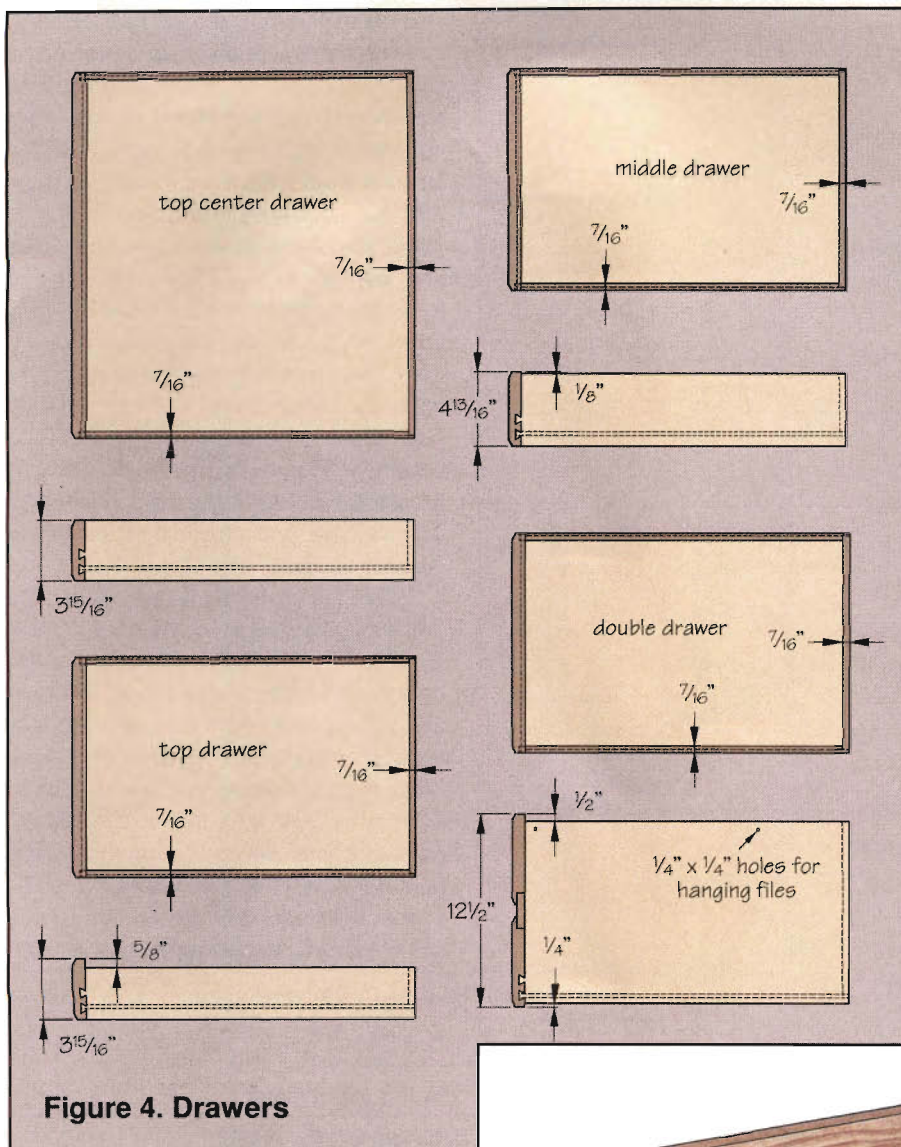


Figure 4. Drawers

heads off.

Assemble the bottom frame. Lay out the frame members (FA, FF, FG and FH) face down, and mark the locations for the dowels (see Figure 3). The bottom center rails (FH) are wide enough to be joined with #20 biscuits to the front (FA) and rear (FF) long rails. Drill the necessary dowel holes and cut the biscuit slots. Next, locate the position of the frame stiles (FO) on the front long rail (FA) from Figure 3. Ensure that they're perpendicular; then clamp, counterbore, glue and attach them with #6 X 1½" screws. Cut the two slots in the edge of each rear long rail (FF) as shown in Figure 3. Dowel and biscuit the frame together; squaring as you clamp.

Build the four drawer frames in the same manner (see Figure 3). The skirt nailers (FL) are edge-biscuited to the front short rails (FJ) on the bottom drawer frames.



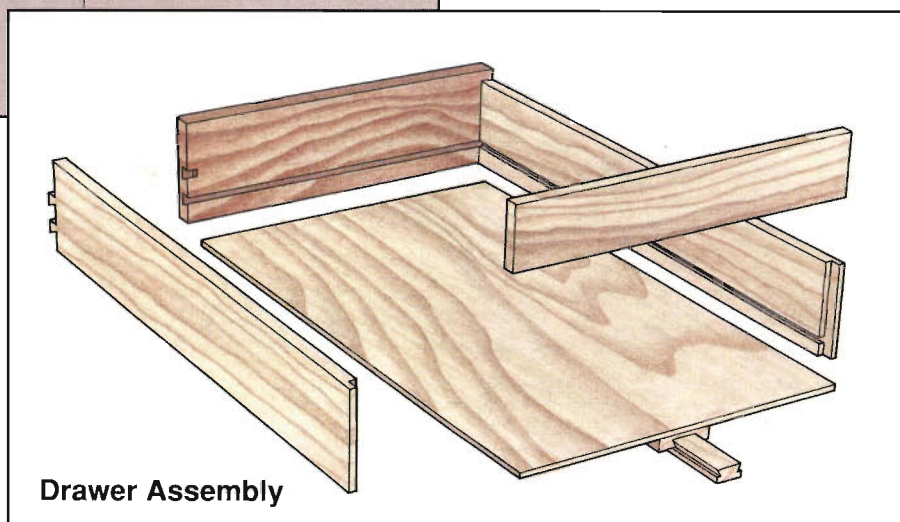
Clamp the frame and align and set the skirt nailer—use a clamp to persuade it into place.



When rearranging the stile and rail bit, don't bend the shaft as you tighten the nut.



The table saw fence makes a good straight edge for clamping the double drawer faces.



Drawer Assembly

The top desk frame dust panels are the only ones that can be routed in place.



It's much easier to round the corners on the panels than to square the rabbets.



Assembly of the Drawer Frames and Paneled Sides

With all the frame pieces and the paneled assemblies dry, and the glue scraped away, try a dry-assembly. Fix what doesn't fit, or the desk won't go together properly.

A number of preliminary steps are required before assembly. Cut out and trim all the desk drawer faces (DDA, DDB, DDC and DDD). I used the ogee portion from my stile-and-rail bit to trim the fronts of each drawer face. Cut a $\frac{3}{4}$ " X $\frac{1}{2}$ " deep rabbet in a top and bottom edge of the double drawer faces (DDD) as shown in the Detail to Figure 4 below. Glue the face-joiner (DDDJ) in the rabbets of the face pieces, and clamp it against a straight-edge until the glue has set. You'll use the drawer faces to ensure that the frames, sides, and backs all go together squarely.

Next, rout the rabbets for the $\frac{1}{8}$ " hard-

board dust panels (DP2 and DP3) as shown in Figure 5. You can rout the breadboard dust panels (DP1) while the top frame is still dry-assembled.

Slide out the top frame and set it aside. Measure, equally space, and mark for the five #10 X $1\frac{1}{2}$ " screws that attach the inner pedestal sides to the bottom frame. Drill and counterbore the ten holes, and run a screw snugly into each hole to cut threads into the hard wood. Remove the screws, and disassemble the desk.

Apply a thin bead of glue to the top of the inner pedestal sides, place the bottom frame into position, and screw it in place with all ten screws. Check for glue squeeze-out, and remove any with a wet sponge or cloth. Set the top frame into position but don't glue it yet.

Have all the necessary clamps, glue, and a small paint brush at the ready. Apply glue in the lower dado, and insert the bottom drawer frame. Do likewise for the upper drawer frame. Apply glue to the dados in the side panel and to the ends of the long rails (FA and FF); then clamp the panel in place. Don't put any glue on the side rail (FG) or the panel (DG) may lock in place; all the panels must float in their frames. Remember to keep the rabbets for the dust panels facing up.

Apply glue to both edges of the back

panel assembly, slide it into position, and clamp. Next, nail the panels in place and set the heads. A pneumatic nailer saves a lot of effort and possible headache. If you prefer to nail the old-fashioned way, remember to drill holes first.

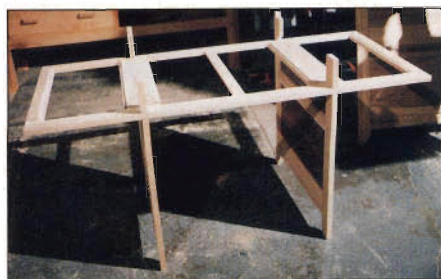
Since the bottom frame isn't located in a dado, place the proper drawer face into position before nailing the outside panel stile (DA) to the long front rail (FA) as shown in the photo on the next page. Make sure all the other drawer faces fit in their respective locations. When one pedestal is complete, construct the other one.

Attach the top frame. Apply glue to the rabbet in the side panels, to the notch in the rear stiles (DA), to the top of the frame stiles (FO), and on the back long rail (FF) from the notches to ends. Set the frame in place, position the drawer faces, then nail the top frame to the frame stiles. Clamp very lightly to just press the side panels against the top frame. If it's clamped too tightly, the drawer face becomes unremovable. Nail the side and back panels to the frame; then stand back and indulge in a little self-admiration.

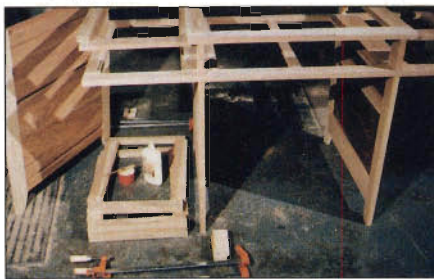
Miter cut the skirt material (DN) to fit around your assembled pedestals (see Figure 1). You may leave the bottom edge flat or cut them out as I did. If you cut them out, nail the identical pieces together in the



If a screw breaks off, use a screw extractor to remove the tip.



Set the center drawer dust panel support level with the bottom of the rabbet.

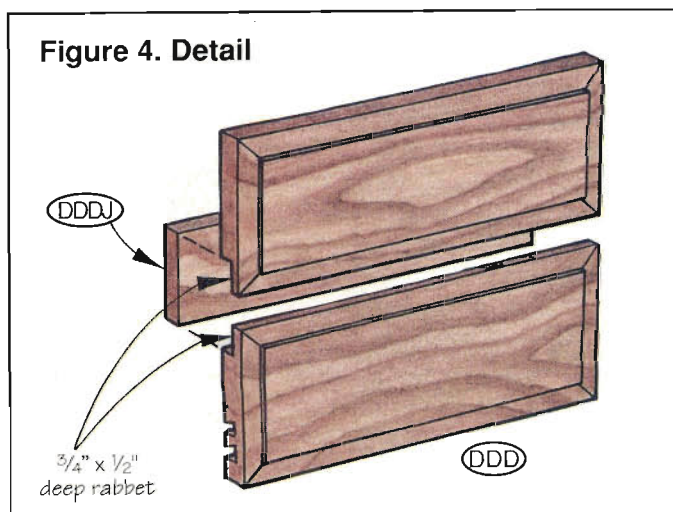


Have everything at the ready before you begin the final glue-up.



A glue pot and brush aid in getting into all the nooks and crannies.

Figure 4. Detail





Allow $\frac{1}{32}$ " clearance around each drawer.



Set the top frame in last.



Check for clearance between the small stiles and drawer fronts.



Remove the edges of the bread board tongues with a back saw.

waste area, mark your lines, and cut them out on the band saw. You may feel more comfortable doing them one at a time.

Making the Breadboards

Plane the two P4 Panels to a thickness of $\frac{3}{4}$ " then cut the two breadboards (DP) to the dimensions given in the Pedestal Cutting List. Plane and cut the breadboard ends (DQ) from a $5\frac{1}{2}$ " X 12" piece. Cut a $\frac{1}{4}$ " X $\frac{1}{2}$ " long tongue on each end of the breadboards. I used a panel cutter and dado blades on the table saw. With a small dovetail saw, remove $\frac{1}{2}$ " from each end of

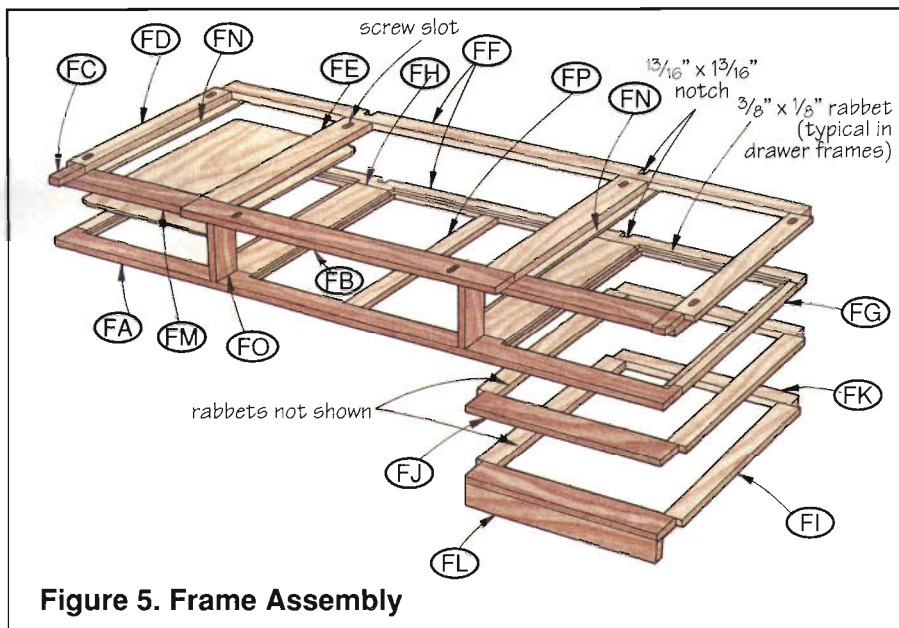


Figure 5. Frame Assembly

the tongue as shown in the photo below left.

To cut the groove in the breadboard ends to fit over the tongue, put a $\frac{1}{4}$ " straight bit in your table router, set a fence $\frac{1}{4}$ " from the edge of the bit and stop blocks at $11\frac{1}{4}$ " to locate the mortise. Plan to make two or three passes to reach your final depth of $\frac{9}{16}$ ". While holding one end of the piece against the right stop, gently ease it down onto the spinning bit. Pressing it firmly against the fence, move the piece to the left stop block. Turn off the router before you attempt to remove the work piece. Do all four breadboard ends at each depth setting.

Since each breadboard and the two end pieces run cross-grain to each other, they shouldn't be glued together. Place a stop-collar on your $\frac{1}{4}$ " brad point bit, and set the depth so the hole will pass through the trim piece, through the tenon on the breadboard, and back into the trim piece—without the tip of the bit poking through ($\frac{5}{8}$ " typically). Clamp the breadboard ends in place, and drill three dowel holes from the underside on each end: one in the center, the other two about $1\frac{1}{2}$ " from the edge. Remove the trim pieces and elongate the two outer holes in each tongue.

Be careful to elongate them only in the cross-grain direction. If the holes end up sloppy, the trim piece will not fit snugly against the shoulder of the tenon and the surface of your breadboard will have a gap along that joint.

Replace the breadboard ends and drive a piece of $\frac{1}{4}$ " dowel rod almost to the

bottom of each hole. First, put a light pencil mark $\frac{1}{2}$ " from the end of the dowel; then drive it in until the mark just disappears. Put a little touch of glue on the dowel at the surface of the trim piece, and drive it the rest of the way into the hole. Trim the protruding ends with a flat saw and sand smooth. Set the top in place and test—slide the breadboards; make any adjustments.

While the top's in position, there're a couple of things you can do—like finishing the top's edges and installing the center back (DO). First, you'll need to cut Panel P3 to 27" X 58". This is a large, heavy piece so make sure you have some help. Clamp a piece of scrap to each end, flush with the edge. Install an ogee bit in your router that's compatible with the ogee in your stile—and-rail bit, and rout the edges (photo to the right). The scrap blocks prevent any tearout and keep the router from wandering around the back corner. Don't cut an ogee on the back edge. Once both ends of the panel are routed, do the front edge.

Making the Drawers

Now for the easy part. The construction of the drawers is pretty straightforward, although there are a few points you need to plan for. Unless you use exactly the same drawer hardware and dovetail configuration, following the plans may cause problems. The thickness of the drawer mounting or sliding hardware determines the location of the drawer bottoms. The location of the bottoms determines the positioning of the dovetails and the width of the drawer backs. (A large part of this

problem can be eliminated by using rabbeted rather than dovetailed drawer fronts.)

Drawer Rule #1: With half-blind dovetails, the dado for the bottom that you cut in the drawer face (pin piece) (Figure 4) must exit through a tail socket, or it will be visible in the side of the finished drawer.

Drawer Rule #2: Unless you want twice the work, set the fingers of your jig equidistant from the edges, so that you cut symmetrical tails in the front edge of the drawer sides and face. You have to reset their position after cutting half the drawer sides, and one edge on the fronts, if you don't.



Use a run-out block or your router may wander around—or splinter the top.



Make sure each side is centered on the fingers before cutting the tails.

You've already cut and shaped all the drawer faces, so refer to the Cutting List and cut all the sides (DDAS, DDBS, DDCS and DDDS), backs (DDAB, DDBB, DDCB and DDDDB), and plywood bottoms (DDAP, DDBP, DDCP and DDDP).

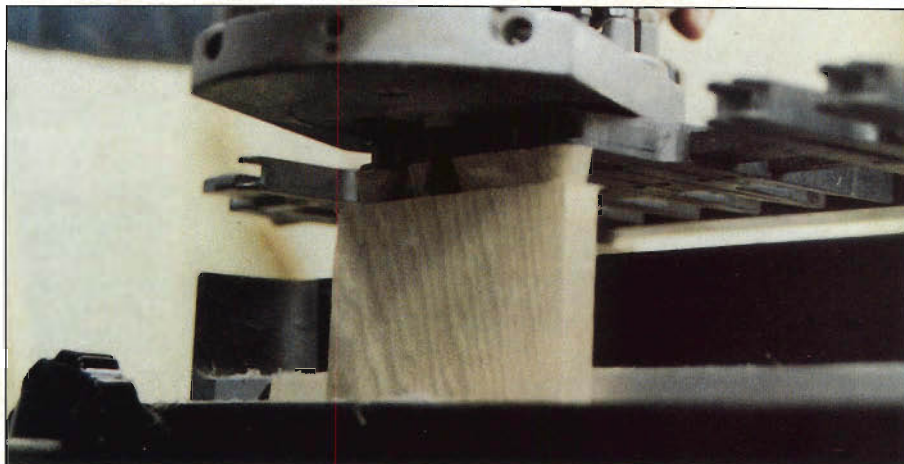
Set up your dovetail jig, and cut the pins and tails in the three top desk drawer faces and sides (DDA, DDB, DDAS and DDBS). I used a Leigh Dovetail Jig; if you have another model, follow the manufacturers directions. Remember to take into account the dado for the bottom. Notice (Figure 4) that the sides (DDBS) of the top outside drawers are narrower than their faces. This allows clearance for the breadboard supports (FM) located in the desk frame. Take this into account so you don't cut an extra pin in those drawer faces (DDB).

If you elect to rabbet your drawer faces,

then—on these top outside drawers—use a router with a straight bit, stop the cut short and chisel the corner square. Cut the rabbets on all the other drawer faces the full height of the drawer.

To practice, I cut a short side piece and drawer face for each size of drawer to set the finger positioning. Test-cut the tails in the side piece; then do likewise for the pins on both edges of the drawer face. Test fit the side on each end of the drawer face, and check it against the finished dimensions shown in Figure 4.

Cut the $\frac{1}{4}$ " X $\frac{1}{4}$ " dados in the drawer faces and all the side pieces. Next, cut the $\frac{7}{16}$ " X $\frac{1}{4}$ " deep rabbet in the back edge of each drawer side. But first, make two stacks of drawer sides on your workbench—left sides, and right sides. If you cut the rabbet on the wrong side of a side piece, you'll



Practice cutting pins and tails on scrap first. The Leigh Jig we used offers the flexibility of individual pin-and-tail width settings.

Finishing The Desk

I wanted a perfectly smooth top—no pores for a pen to catch in while writing. I learned about a product called GOOP-ON from a friend in the flooring business. It's a pore-filler and you apply it exactly as the name implies. Be sure to have adequate ventilation. Push it by the finger-full into the end grain of the ogees, and squeegee it liberally into the pores. Let it dry overnight; then sand. I used a random orbit sander with 120-, 220- then 320-grit. The top, with GOOP-ON filled pores, required an extra coat of stain to match the rest of the desk.

My wife agreed to stain the desk—after all, it was going to be hers. She chose Brown Mahogany from Bartley, the manufacturer of antique reproduc-

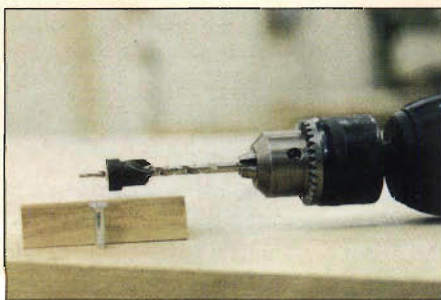
tion furniture kits. It's a gel stain with the consistency of pudding, and it goes on like silk. You rub it in with the direction of the grain—about three square feet at a time—then rub it off. It has polyurethane in it, and dries to the touch in just a few minutes—wait six hours before applying the next coat. What I liked most about it was that it didn't raise the grain on the

wood, further sanding wasn't required, and it didn't turn the end grain dark like most other stains. The only drawback with emulsion-based stains can come from using latex gloves to handle the stained wood. (See Chip Howard's letter in the *Finishing Forum* on page 13).

After she applied two coats of stain, I used their clear varnish for a final coat. It's applied just like the stain. Along with the clear varnish, Bartley offers the stain in twelve shades. They also offer ten opaque accent colors. Call 800-227-8539 to order or ask for their catalog.

When all is dry and to your satisfaction, attach all your drawer hardware. Sit back and enjoy your desk—it won't be too long before Part II arrives; then it's time to build the rollout. See you then.





Reverse the counter bore to make a drill stop. Use a spacer block to prevent driving the screw through the top of the desk.



The double-drawer slides, in conjunction with the edge rollers, give each drawer a 50 lb. maximum weight limit.



A 90° offset hex-drive for your cordless screwdriver beats using a stubby Phillips.

probably have to make a new drawer face and both sides over again—unless you're lucky enough to cut the tails in exactly the same positions as the ruined piece.

Before assembling the drawers, there are a few small tasks to take care of. First, I bought a box of legal-sized hanging folders and used one to locate the positions of the holes for the $\frac{1}{4}$ " support rods (Supplies List) in the double drawers. Their approximate locations are shown in Figure 4. Drill these holes $\frac{1}{4}$ " deep. Use a hacksaw to cut the rods to length.

I then set up the mortising bit in my drill press and cut the mortise for the center drawer lock. After boring the holes for the

key and escutcheon (the metal keyhole protector), I sanded and stained all the drawer faces. Next, I clamped a fence and stop block on my drill press and drilled the holes for all the drawer-pull hardware.

To assemble the drawers, apply a light coat of glue to the tails and rabbets in matching side pieces. Slide the tails into the pins, fit the back into the rabbet and slide the bottom (without glue) into position; then square and lightly clamp. On the two double drawers, don't forget to put the steel rods in place before you clamp up the drawer.

When the glue has dried, secure the bottom to the back with a small nail or screw. Remove the clamps and test-fit each of the drawers. Sand and persuade where needed. When you're happy with the sliding action, set each drawer in its closed position. Start

with the top row of drawers, and measure the distance from the back corners of each drawer to the desk back panel. Use these numbers to make stops—six for the top row—and glue them in place. Remove the top row of drawers, measure and make the stop-blocks for the next two drawers...and the last two.

Cut the dust panels (DP1, DP2 and DP3) to the dimensions given in the Dust Panel Cutting List. I used double-sided hardboard (even though it's a bit more expensive) because it's $\frac{1}{8}$ " thick. Single-sided is a little fat, and the unhardened side gets fuzzy when you cut and sand it. Rather than square all the rabbeted cor-

ners in the desk frame with a chisel (fifty two in all), I rounded the corners of the hardboard on my combination sander

Set all the panels in place; then mount your drawer slides. I used the dovetail slides, listed in the Supply List, for all the drawers except the bottom, hanging-file ones. Because they carry more weight, I used Delta Drawer Slides (photo middle left).

Attaching the Top

Using the approximate locations shown in Figure 3, mark and drill the eight oblong holes in the top frame members. Drill for #10 screws. To counter sink from under the frame, I used a standard counter bore in a 12" bit extension. The direction of movement in the top is perpendicular to the grain, so elongate the holes in the frame in this direction.

Retrieve the top and position it on the desk. Align the back edge flush with the back of the desk; the sides and front have 1" of overhang. With the top in position, clamp it to the desk. Use a scratch awl or pencil, up through the drilled holes, to mark the location of the screws in the top.

Remove your clamps and turn the top over. Set a collar on your #10 counter-bore so the distance from the tip of the bit, to the bottom of the collar, measures $1\frac{1}{16}$ ". Drill the eight holes where marked. Place a small piece of scrap that's $\frac{13}{16}$ " thick next to one of the holes, and set a #10 X $1\frac{1}{2}$ " FH screw flush with the top of the scrap as shown in the photo, upper left. Be very careful not to drive the screw all the way through the top. Remove the screw and repeat the procedure on each of the holes.

Set the top off to the side. Start with a #10 X $1\frac{1}{2}$ " FH screw and insert it up through one of the holes in the frame. The height of protruding thread must not be any more than $\frac{5}{8}$ " above the frame. On the outside frame members (FD), you may need to use a $1\frac{3}{4}$ " screw to compensate for the added thickness of the breadboard slides (FN), but don't take my word for it—measure it.

Align the top back in place and screw it down to the desk. You are going to need a stubby screw driver to get into the tight places. This is also a perfect excuse to go out and buy that 90° offset you've been looking at. The one I have (AEG—phone: 800-243-0870), has a standard hex-drive; and fits in a drill chuck or cordless screwdriver. **[PW]**

Sturdy Shop Tables

by Jacob Schulzinger

Designing work tables and benches for shop use is different than designing furniture for the home or office because of the heavy use that the pieces will receive. However, the daily use factor is not the deciding element in the design of these items. Vibration, pounding and the shock from bumping that occur in shop use determine the material, assembled weight, and joints to be used in these structures. Other influencing factors are portability, required work area, convenient working height and space available. I took all of these factors into consideration when determining the basic design for a simple shop table and then sought the best possible joint to fit all future potential uses.

The joint that I wanted was one that would not come apart with hard use, would be easy to produce, allow for fast and easy assembly and would convey the messages of both craftsmanship and utility. The half lap dovetail joint fit all these criteria. The dovetail portion of the joint would be attractive and would prevent the legs from splaying while the half lap portion would help keep the legs from twisting and from pulling in towards each other. The combination of the two would make final assembly a simple task.

To test the design, I made a belt sander stand. This application requires a base that will hold a moderately heavy tool, be exposed to the usual abuse that occurs in a shop and will be used in a high vibration situation. In all categories, the table came through with flying colors. While the mate-

Jacob Schulzinger is an industrial engineer in the aerospace industry. Woodworking is his part-time business and hobby.

rial I selected for the table was maple, you can use any hardwood of your choice.

My intent was to produce a number of these tables, so I decided to mechanize the manufacturing process to make the parts interchangeable. Because both the tails and pins would be machine cut, the pin is prepared first and the tail fitted to it.

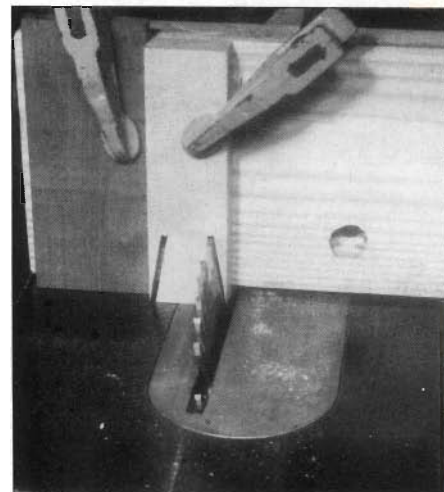
The Tails

Before beginning work on the tail, make an auxiliary back for your table saw miter gauge. The rails you'll cut will be sticking straight up, so make the auxiliary back as tall as possible. A 2 X 10 is good for this. After planing and squaring up all the edges, mount the board to the miter gauge and set the gauge at 90°. Set the table saw arbor tilt to 10° and make a test cut on a piece of scrap. Adjust the blade angle as required to make the tail fit perfectly in the test pin you prepared earlier.

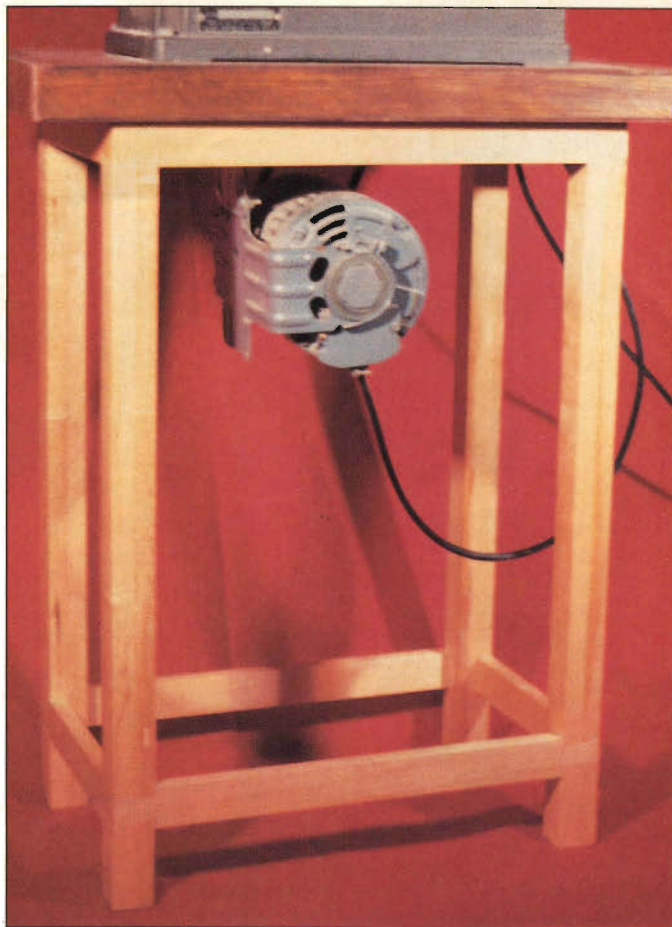
Prepare some test boards for the tails that will be the same width and thickness of those that will be used on the table. Position the center of the 15/8" dovetail on the end of a test board and scribe it with a

knife. Set the test piece against the auxiliary back of your miter gauge and, after aligning it vertically, make the first cut only about 1/4" high. Before removing the board, clamp a guide block to the miter gauge to help you to re-align the board. Unclamp the test piece, turn it around, and make the second cut. Check the results against the sample socket and make any adjustments

Cut a sample tail to check the accuracy of your pins.



author



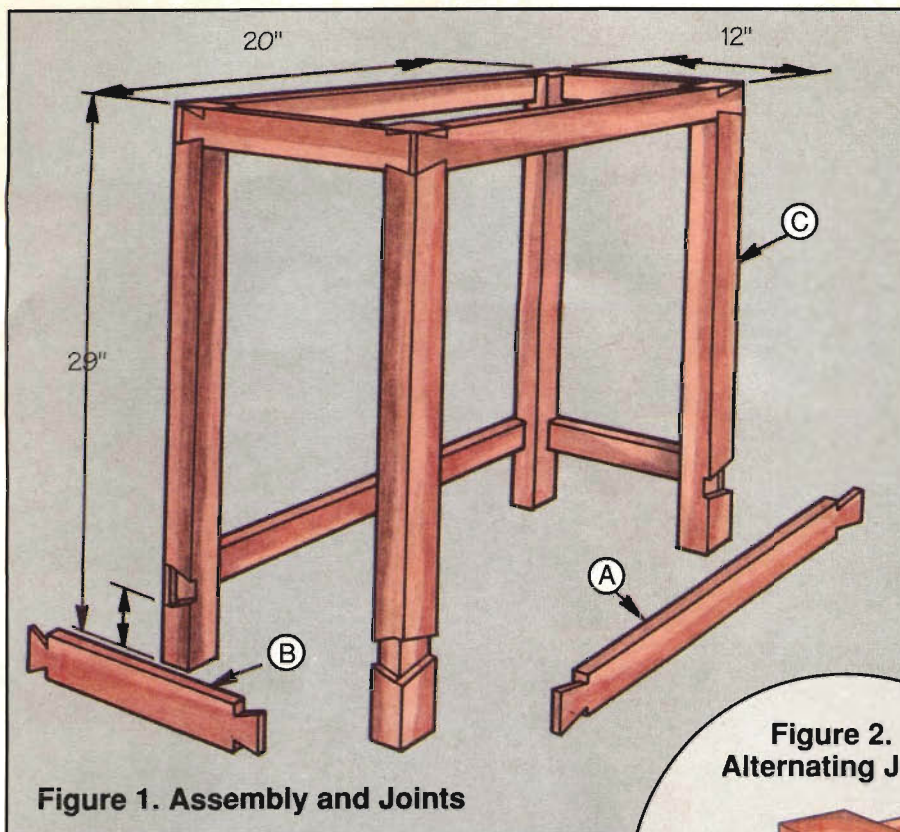


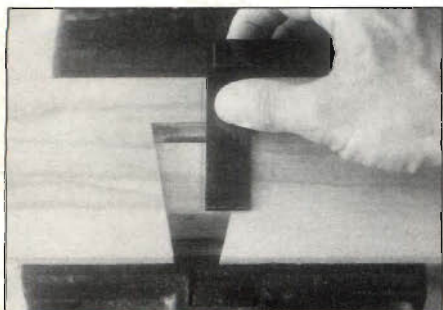
Figure 1. Assembly and Joints

to the tail width as needed.

When the tail width is correct, raise the blade to $1\frac{5}{8}$ " and finish cutting your sample tail. Exercise extreme caution when making these cuts since the blade extends high off the table and there is no guard to protect you. Square the shoulders of this sample and test fit it in the pin that you made earlier. When you're satisfied with the fit, the table saw can be reset for preparing the shoulders. When cutting the rails (A and B), cut all of the tails first. Without moving the guides, reset the blade to 90° and set the blade height to cut out the corners to complete the dovetail profile. Clear out any corner waste with a chisel and test the results against the pin.

The shoulder portion of the half lap tail can be cut using the same guide block and

Align the jig center with the scribed lines on the leg to position the pins.



blade angle settings. The depth of the shoulder is half of the rail material thickness, or $\frac{3}{8}$ ". The remainder of the half lap can be cut using either a table saw or a router. In either case it is important that all of the leg and rail preparation be completed before this step begins since you will change the set up of your tools

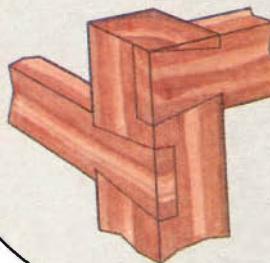
Table Construction

Prepare of the stock for the legs (C). Use 2 X 2 stock that is finished to $1\frac{5}{8}$ " X $1\frac{5}{8}$ " and make at least one 12" long sample block in which to fit the tails.

Rip the eight rails to $\frac{3}{4}$ " X $1\frac{5}{8}$ " and at the same time, make a few 8" boards to check the blade settings for the tails. I made these out of pine to get the rough initial settings on the table saw. While pine works well here, don't use it for test fits as it compresses too much when fitted to the pins.

Prepare the dovetail pins at this time. Because you are using hardwood, you will have to make at least three passes with the router to get the depth you want. Make

Figure 2. Alternating Joints



a simple stepped block for measuring the router bit depth of each pass. I use a piece of scrap pine with a $\frac{1}{4}$ " thick piece of plywood tacked to it to duplicate the thickness of the router template for this purpose. Make the first two routing passes on a leg, making sure that you mark the measuring block with a pencil for each of the cuts made. Set the router to the final depth, take a light cut on the gauge block and then finish the pin without changing the setting. The gauge block will be used to verify the final router bit depth setting for each pin prepared.

Lay out the legs and mark them clearly to show in which position they will be when assembled. Use a knife to mark the pin center lines. These marks should be clearly visible since they will be used for template alignment. The center line for the dovetail pin at the top of each of the legs should be marked about $\frac{1}{2}$ " lower than actually desired to provide extra material around the joint. This prevents the wood from splitting when the tails are inserted. Remove the extra material after all the rails have been installed.

If you plan to have the rails in horizontal alignment with each other as shown in Figure 1, you should only rout two pins on each leg at a time. Also note that the longer rails extend to the ends of the legs and the short rails butt up against them, so if you alternate the pin positions (Figure 2), add $\frac{3}{4}$ " to the short rails. Use the gauge block as a depth guide and align the center lines on the legs with the center line marked on the router template. Only after the rails have been installed in these sockets should the remainder of the sockets be cut. If you elect to stagger the rails on adjoining legs, cut all of the sockets at once.

Before assembling the legs and rails,

Sturdy Shop Tables

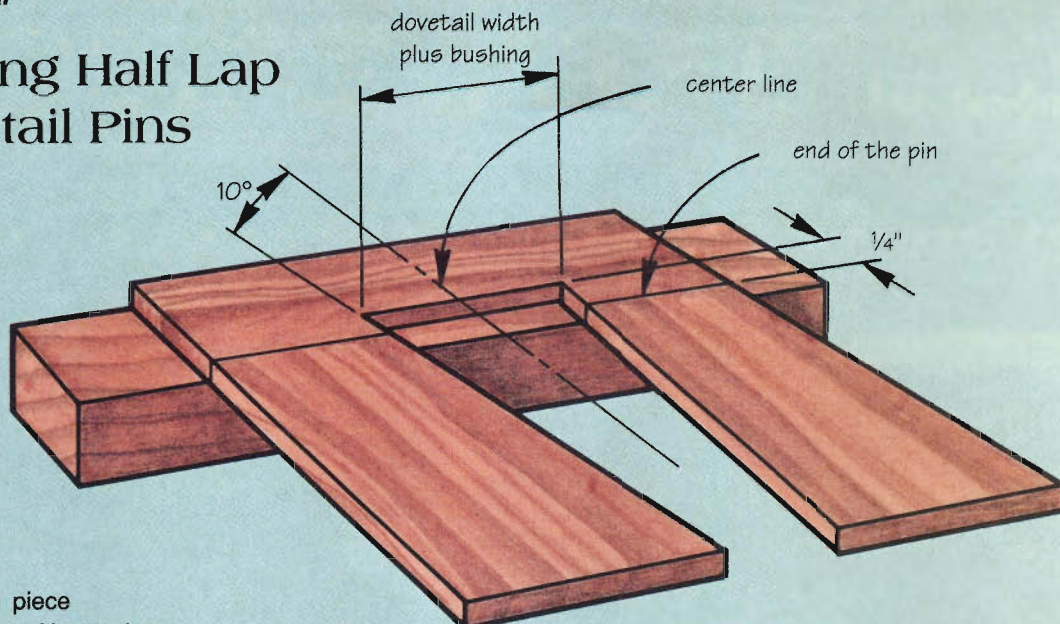
Cutting List

Qty	Part	Finished Size			Piece
		T	W	L	
4	A	$\frac{3}{4}$ "	$1\frac{5}{8}$ "	20"	long rails
4	B	$\frac{3}{4}$ "	$1\frac{5}{8}$ "	$11\frac{1}{4}$ "	short rails
4	C	$1\frac{5}{8}$ "	$1\frac{5}{8}$ "	29"	legs

Bob Chapla and Ginny Pruitt

Routing Half Lap Dovetail Pins

Bob Chapla and Ginny Pruitt



Cut a piece of $\frac{1}{4}$ " X 6" X 12" plywood and glue and screw it onto a 2" X 2" X 15" piece of hardwood. Use #6 X $\frac{1}{2}$ " flat headed screws and countersink them deep enough so that the router base doesn't catch on them. Scribe a center line perpendicular to the hardwood (6" from each end) and a line where the shoulder of the hardwood block meets the plywood using a sharp knife. The point where the lines intersect is the center of the end of the tail. As you will be using a router bit with a guide bushing in this template, calculate the clearance to determine the correct dimension of the cutout at its widest point. I chose a $\frac{5}{16}$ " diameter carbide router bit with a $\frac{5}{8}$ " guide which gives an additional clearance of $\frac{5}{16}$ ". Add the width of the dovetail, which in this case is $\frac{15}{8}$ ", to get the total template width of $1\frac{15}{16}$ ". Divide by 2 to get $\frac{31}{32}$ ". This is the dimension on each side of the center point that marks the widest points of the tail cutout.

Instead of using the traditional 1:8 ratio for this hardwood dovetail, I used an 80° angle which is

similar and is easier to set on a table saw. Use a sharp knife instead of a saw to cut this shape on the template and make a straight, clean cut. After cutting out the pattern, extend the length at the wide end of the tail $\frac{1}{4}$ " to allow the router bit to travel past the blind end of the cut. Clamp the template to a piece of hardwood in a bench vise and test cut an $\frac{1}{8}$ " deep pin. This pin is used to check the tails that will be made later.

Once the template is done, minor adjustments can be made to the shape it creates by changing the distance between the blind end of the template and the 2 X 2 backstop. If the pin is too wide, use a shim made of a piece of veneer, cardboard, or even some folded paper between your piece and the backstop. If the pin is too narrow, trim a slight amount from the backstop. When the pin is just a hair too wide, a very minor adjustment can be made by wrapping the guide bushing with some masking tape. **PW**

break their edges and make sure that the rail shoulders and the pins are left sharp to look their best. Assembly is very easy—the design of the joint makes it self-aligning. Use glue in the sockets and on the shoulders sparingly because too much glue will only squeeze out and make a mess. It should require some pressure to get the parts to fit together, and I generally clamp over each pin to fully seat it.

If you kept the table rails horizontally

aligned, you can get ready for the next round of pins once the glue has dried. To do this, line up the router template with the center lines marked on each of the legs and clamp the template securely in place. Secure the assembly in a vise and follow the same sequence of cuts. When all of the pins have been cut, assemble the final four rails and legs. Clamp the joint until the glue has fully dried.

I finished off this table base with a few

coats of tung oil followed by a single coat of paste wax. With the base completed, any specialized table top can be attached to suit your shop needs. I made a very simple table—it was some 2 X 4s glued between $\frac{1}{4}$ " plywood with a few strips of plywood glued to the ends of the assembly for a neater appearance. A little stain, a few coats of varnish to protect it and the assembly was ready to mount a 6 X 48 inch belt sander on top. **PW**

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Calendar

Events of Interest to Woodworkers

If your group is having an event you would like other woodworkers to hear about, please send us all pertinent information at least three months before the opening date. We will publish it for you in *Calendar* free of charge.

California

Exhibit and Competition: San Diego Fine Woodworker's Assoc. "Designs in Wood" (6/16-7/5), Southern Calif. Exposition, Del Mar, CA 92014-2216
Contact: The San Diego Fine Woodworkers Association, P.O. Box 99656, San Diego, CA 92169

Woodworking Show and Classes: College of the Redwoods Student Show (5/16-6/8), Highlight Gallery, 45052 Main St., Mendocino, CA 95460. Tel. 707-937-3132. Classes: Beginning Carving (6/8-19), Tools and Techniques (6/22-7/10), Seminar with James Krenov (7/11-12), Projects with Michael Burns (7/13-8/7), 440 Alger St., Fort Bragg, CA 95437. Tel. 707-964-7056

Building the Norwegian Pram: with Simon Watts (6/6-12), National Maritime Museum, Bldg. 275, Crissy Field, San Francisco, CA 94129.
Contact: The National Maritime Museum Assoc., tel. 415-929-0202

Colorado

Furniture Workshops: Basic Woodworking (6/8-19), Faux & Painted Finishes (6/8-19), Design and Techniques (6/22-7/3), Willow Furniture (6/29-7/3), Intermediate Furniture Making (7/6-10), Marquetry, Veneering & Inlay (7/6-10), Upholstery Design & Technique (7/13-17), Anderson Ranch Arts Center, P.O. Box 5598 Snowmass Village, CO 81615. Tel. 303-923-3181

Woodcarving Festival & Competition: Colorado Woodcarving Guild Festival (7/10-19), competition (7/11-12), T.J. Max Center, corner of Palmer Park and Academy Blvd., Colorado Springs, CO.
Contact: Jerry Case 2613 Alteza Lane, Colorado Springs, CO. 719-597-3297

North Carolina

Workshops: Ladderback Rocking Chairs (6/22-27), 17th Century Joinery (7/6-11), Toolmaking for Woodworkers (7/20-24), Windsor Chairmaking (8/3-8), Country Workshops, 90 Mill Creek Rd., Marshall, NC 28753. Tel. 704-656-2280

Folk School Workshops: Woodcarving: Spirit Face (6/5-7), Red Fox (6/14-20), Folk Figure (6/21-27), Advanced (7/5-11) & (7/12-17), Hound Dog (7/17-19), Caricature (7/19-25) & (7/26-8/1), Basic (8/2-8), Santa (8/14-16). Woodturning: Boxes and Bowls (6/14-20), Basics (7/12-17), Skills (8/2-8). Woodworking: Banjo Making (6/28-7/4), Norwegian Bentwood Boxes (7/5-11), Shaker Boxes (7/17-19), Textile Tools (7/19-25). John C. Campbell Folk School, Rt., Box 14-A, Brasstown, NC 28902. Tel. 800-562-2440

New Jersey

Woodworking Festival: (7/31-8/2), Meadowlands Convention Center, Secaucus, NJ
Contact: Roth Exposition Group, 19th South B St., Ste., 11, San Mateo, CA 94401. Tel. 415-340-9767

Woodcarving Benefit Show: South Jersey Woodcarvers 13th annual show to benefit the American Cancer Society (6/6-7), New Jersey National Guard Armory, Cherry Hill, NJ
Contact: Pat DeAngelis 609-227-1969, or Louise Wyckoff 609-468-6846

Oklahoma

Woodcarving Show: E. Oklahoma Woodcarvers Assoc. (7/10-12), Tulsa Promenade Shopping Mall, 4107 South Yale Ave., Tulsa, OK 74135.
Contact: Henry and Sally Moreland, 803 Comet Street, Claremore, OK 74017. Tel. 918-341-3809

Oregon

Wood Finishing Workshop: English Finishing Techniques (7/13-17), Conservation & Restoration (7/20-24), Oregon School of Arts and Crafts.
Contact: Valerie Hadley, 8245 SW Barnes Rd., Portland, OR 97225. Tel. 503-297-5544

Pennsylvania

Woodworking Festival: (6/5-7), Valley Forge Convention Center, Philadelphia, PA

Contact: Roth Exposition Group, 19th South B St., Ste., 11, San Mateo, CA 94401. Tel. 415-340-9767

Tennessee

Woodturning Workshops: (6/8-12), (6/15-19), (6/22-26), (6/29-7/10), (7/13-17) & (8/3-7), Arrowmont School of Arts and Crafts, 556 Parkway, Gatlinburg, TN 37738-0567. Tel. 615-430-4101

Utah

Woodturners Symposium: American Assoc. of Woodturners (6/18-20), Brigham Young University, Provo, UT.
Contact: Mary Redig, 667 Harriet Av., Shoreview, MN 55126. Tel. 612-484-9094

Virginia

Wood Collectors Event: Woodfest International (6/7-11) Blacksburg, VA
Contact: Lloyd Sumner, 5900 Chestnut Ridge Rd., Riner, VA 24149. Tel. 703-382-1974

Vermont

Woodcarving Classes: Carousel Horse Carving (7/6-10), Power Carving for Beginners (7/20-24), Bird Carving (7/11-12), Carving with Power Tools (7/13-17), Fletcher Farm School for the Arts and Crafts, RR 1, Box 1041, Ludlow, VT 05149. Tel. 802-228-8770

Cabinetry Workshop: Cabinetry I (7/12-18), Cabinetry II (6/7-13) & (7/19-7/25), Cabinetry III (7/26-8/1), Yesterday Tomorrow Design/Build School, Warren, VT 05674. Tel. 802-496-5545

West Virginia

Craft Workshops: Basic Cabinetry (8/3-7) & White Oak Basketry (8/3-7), Crafts Center, Cedar Lakes, WV 25271. Tel. 304-372-7005

Canada

Woodturning Workshop: Design and Technique (8/1-3), Kelsey Campus, Saskatoon, Saskatchewan, Canada
Contact: Saskatchewan Craft Council, 813 Broadway Ave., Saskatoon, Sask., S7N 1B5. Tel. 306-653-3616

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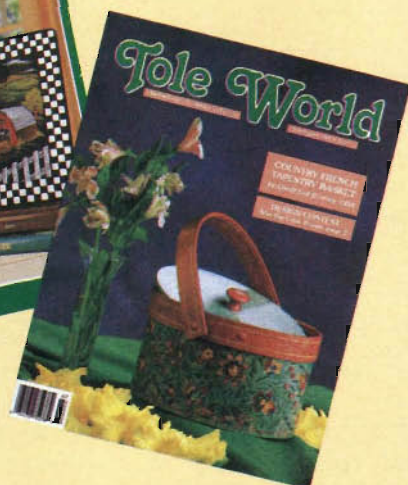
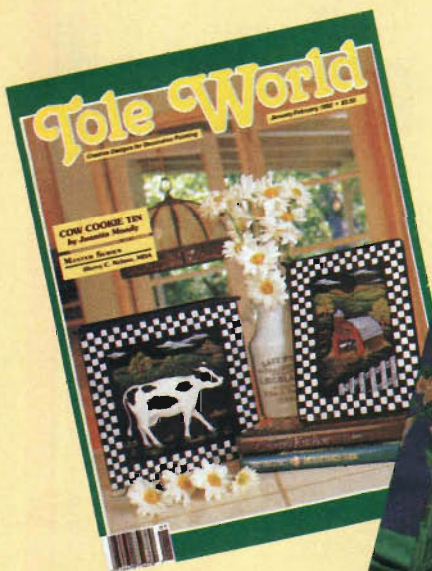
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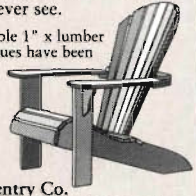
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Dust Collectors

Protecting Your Lungs

The health risks associated with long-term exposure to wood dust are real. Plenty of research has gone into the study of airborne particulates, and OSHA has released new restrictions on the amount of sawdust that's tolerable before respirator protection must kick in. To some folks, these standards—and the even more stringent rules now being set up in Europe—are examples of bureaucracy run amuck. But for most craftsmen, these standards are a welcome change. Some manufacturers have searched diligently for better dust control methods, but a few have required a push.

If you own a shop but not a dust collection system, then you're in a state of denial. Federal standards don't change overnight, especially when new rules make manufacturers and their lobbyists upset by elevating production costs. If you make dust and breathe it on a regular basis, you need a dust collector.

Its Ancestor Was A Vacuum

Today's dust collector has its roots in the lineage of household vacuums. The basic principle is the same—a motor turbine sucks in chips and fine dust—but that's where the similarity ends. Instead of dumping the dust into an internal bag like a vac, the large collector sends it into a pair of vertically oriented bags. The debris flies into the air column and heavy particulates settle to the bottom bag, while filtered air pushes out through the higher bag.

The amount of suction you require depends on both the type and amount of work you do and on the location of your machines. If you work heavily in the shop and machines are not close together, then you might want to consider piping to a 3 hp, 230-volt unit. On the other hand, if you don't have the extra space or money for a huge collector, consider one of the portable machines. They're compact and easily fit under most woodworking machine stands. But they can't perform like the bigger machines, and transferring one from your jointer to the table saw can

become a nuisance. However, these mini-units have their place in the smaller shop.

A note of caution: don't look at this article as a comprehensive comparison. Since the horse-power and chip collection capacity differ from machine to machine, we're including only a small selection of collectors from a variety of manufacturers. We rate the machines, but base the scores on how well each unit fares against its potential, not on how well it performs against the other machines. A further note—noise can be as dangerous as dust. We threw out the manufacturer's supplied decibel ratings and took our own, and they don't always match the maker's specs.

AMT Model 4710

American Machine and Tool Company operates three plants in Pennsylvania, but this unit comes from Taiwan. That doesn't mean it's a bad machine—AMT scores consistently well in

product quality against the majority of importers. It's a 1 hp collector which works well when taking care of one machine at a time. It could service two closely situated machines by employing a blast gate to block off one.

This is AMT's only model, and though it's adequate, be aware that the hose supplied with the machine is basically a dryer hose. The thin walls typically give way to larger pieces of shrapnel. On the other hand, hose isn't often supplied, so at least you won't be procrastinating on set-up for lack of hose. However, the catalog specifically states that the hose is not included, so our test unit may have been an exception.

It's one of the quieter machines tested, and the unit rolls around the shop easily. Some collectors have their bags secured to them with hose clamps. They're a hassle to unscrew and empty. AMT sews a strap into the bag and all you have to do to release it is pull on a single buckle. Reattachment is just as easy—pull the strap and it cinches up tightly around the machine's waist.

Part of our scoring comes from the collector's filtration quality. If lots of particles get through the bag system, then we drop points. The AMT rates about average and it offers you a single-machine alternative with an import's



Sanford Wilk, a builder and organic architect in Boston, Massachusetts, heads a team of craftsmen who evaluate tools under actual working conditions.

competitive pricing. No frills but worthy of the small shop. (American Machine & Tool Company, Inc., Fourth Ave. and Spring St., Royersford, PA 19468 . Tel. 215-948-3800)

Delta Model 50-179

You may have noticed that Delta doesn't participate in our tests on a regular basis. That's too bad since this sister company of the fantastic folks at Porter-Cable typically scores well. This unit is no exception to Delta quality, and its fine particle filtering and low noise level beat out the other units in its class.

It's the only unit we could find with a two-stage filtering process. The larger chips fall into a 35-gallon rigid canister—heavier than a bag, but keep in mind you're getting 35 gallons between dumpings instead of the average 11 gallons you get with similarly powered machines. The Delta unit's motor comes after the first drop point for chips. A 4" inlet leads to the drum and after



the heavy stuff settles, the motor sends the finer dust into a secondary cloth bag. This is the best system for tiny particle control we've come across.

It's not perfect, however—the secondary filtration bag has a zipper on the bottom side for easy empties. But when the bag gets full, it sinks low and doesn't offer the user much space between it and the floor for receptacle placement. We unscrewed the hose clamp and removed the bag each time it required emptying—a bit of a hassle.

The unit is on casters, so it's reasonably portable, and the drum is lined with aluminum foil to resist fires caused by smoldering chips. The folks at Delta do include five feet of quality hose as well as a nice 8-foot cord. If this collector is any indication, Delta ought to participate in our testing regularly. (Delta Intl. Machinery Corp., 246 Alpha Dr., Pittsburgh, PA 15238. Tel. 800-438-2486)

Makita Model 410

This is an extremely portable (20.4 pounds) and compact unit. The biggest drawback is the size of the inlet. Most machines in the shop have a 4" diameter port but the Makita collector only offers a 3" inlet. You'll need to figure a reduction fitting into the purchase. A second drawback is the high noise level. On the other hand, this is a safety-oriented machine. Makita has installed a safety switch on the inlet that detects the presence of a hose. If the supply hose is missing, the machine refuses to operate. This could save your fingers from a fast-turning turbine blade.

A good quality hose comes standard with the machine. It's customized on one end to accept a locking pin for collector attachment. Keep in mind that it's designed to operate with other Makita shop tools. A series of optional hoods and ports are available to hook it up to large units like the company's thickness planer. Makita added a final frill by installing a plastic window into the bag so you can gauge how full it is. It's a novel approach and a necessary one, too, since this bag rests on the floor itself. (Makita USA, 14930 Northam, La Mirada, CA 90638. Tel. 714-522-8088)

Penn State Model DC-3

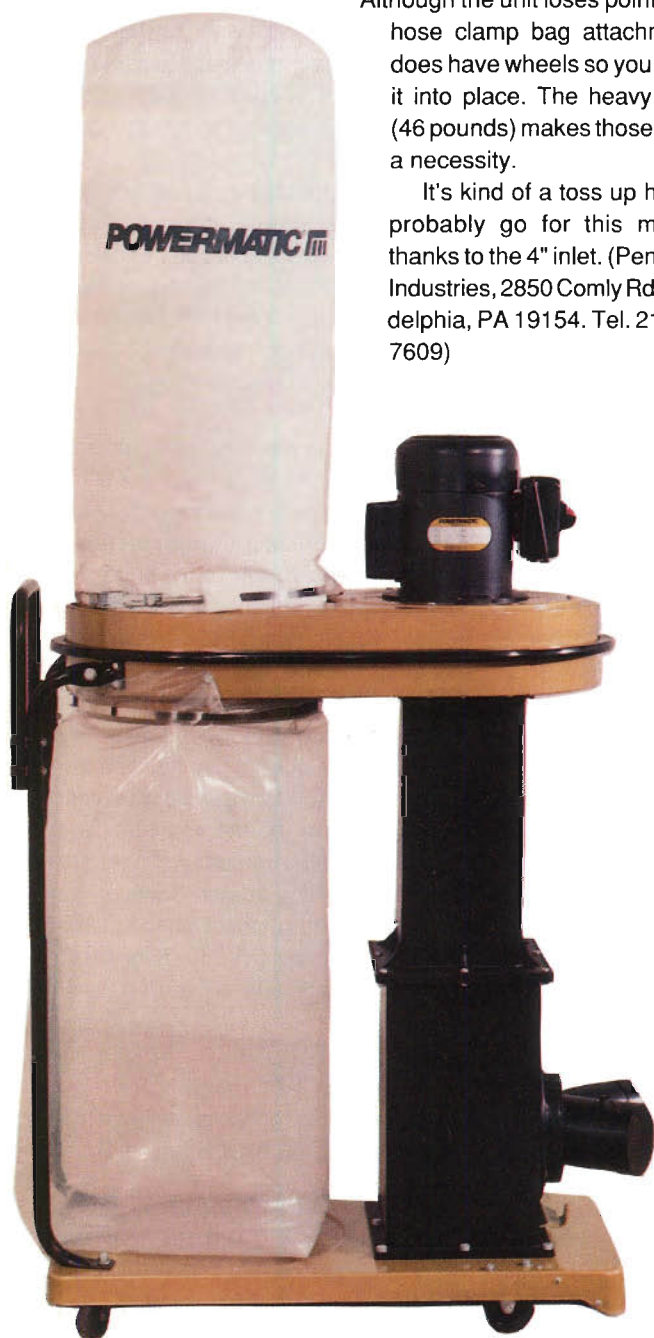
Like the Makita, this is a single-minded collector designed for one machine at a time. The big plus Penn State offers is that it



takes a standard 4" hose on the inlet. It's also more powerful and that means better collection abilities. The bag, however, is sized under the Makita unit and that means more time spent dumping.

Although the unit loses points for its hose clamp bag attachment, it does have wheels so you can roll it into place. The heavy weight (46 pounds) makes those wheels a necessity.

It's kind of a toss up here. I'd probably go for this machine thanks to the 4" inlet. (Penn State Industries, 2850 Comly Rd., Philadelphia, PA 19154. Tel. 215-676-7609)



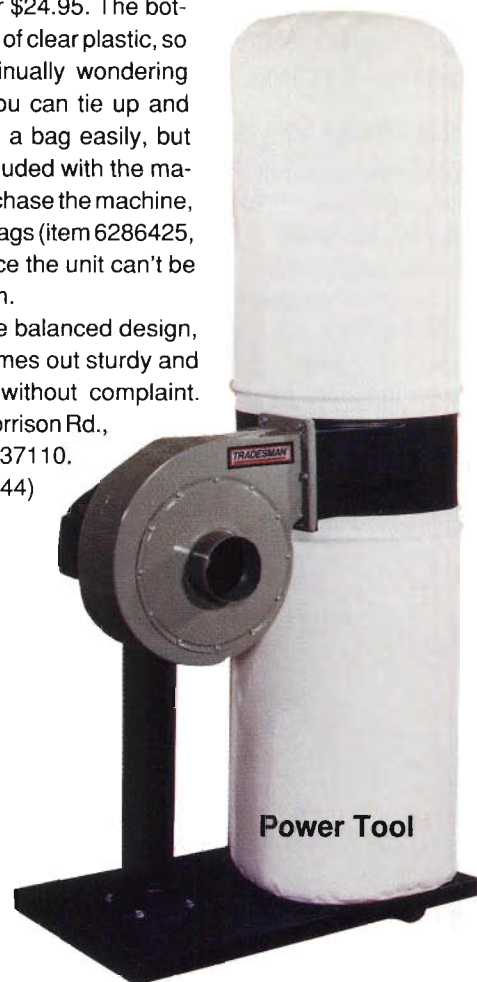
Powermatic Model 073 Artisan

This unit boasts two 4" inlets instead of the average single intake feed. It also incorporates a unique floor sweeper that turns the machine into a rolling shop vac/sweeper. The extra port is rectangular and located on the undercarriage of the stand, which can roll around the shop. The floor sweeper is controlled by a built-in blast gate and a push handle situated behind the bag system.

This unit rates as an excellent combination of power and versatility but for one drawback—the filtering capability of the coarsely-woven cloth bag is less than adequate. Due to the number of complaints they've received, Powermatic has announced they'll soon have a tight-weave bag for their collector

that will retail for \$24.95. The bottom bag is made of clear plastic, so you're not continually wondering how full it is. You can tie up and dispose of such a bag easily, but only two are included with the machine. If you purchase the machine, buy a supply of bags (item 6286425, \$4.95 retail) since the unit can't be run without them.

Thanks to the balanced design, this collector comes out sturdy and it takes abuse without complaint. (Powermatic, Morrison Rd., McMinnville, TN 37110. Tel. 800-248-0144)



Power Tool Specialists Model 9990

Like many other Taiwanese imports, quite a few different names roll off the same assembly line. This happens with lathes, jointers, scroll saws and even dust collectors. This machine may or may not come from the same overseas source as the AMT, but it matches it almost exactly, so we're making that assumption. On the other hand, the Taiwanese are known for replicating existing popular favorites, so maybe they've started borrowing designs from each other now. Either way, this unit stands to be the same reasonable-to-good choice as the AMT for obvious reasons. (Power Tool Specialists, 3 Craftsman Rd., E. Windsor, CT 06088. Tel. 800-243-5114)

Reliant Models NN720, NN820 and NN830

Stan Black at Trend-Lines is the conspirator here. This guy is bright and he figured that his company could offer quality machines at a lower price by going directly to the Taiwanese instead of through a middle man. It was a gamble



Dust Collectors

Maker	Model	HP	Voltage	CFM	Chip Capacity	Inlet	Noise Level	Weight	Score 1-10	MSRP
AMT	4710	1	115	610	4CF	4"	79dB	64lb	7.5	\$239*
Delta	50-179	¾	115	580	4.7CF**	4"	72dB	53lb	9	\$424*
Makita	410	1¼	115	307	7CF	3"	90dB	20.4lb	7.5	\$540*
Penn State	DC-3	1½	115	760	2.2CF	4"	85dB	46lb	7.5	\$209*
Powermatic	073	1½	115	900	4.75CF	4"	85dB	125lb	9	\$399
PTS	9990	1	115	610	4CF	4"	79dB	64lb	7.5	\$249
Reliant	NN720	1	115	610	5.24CF	4"	74dB	128lb	8	\$230
Reliant	NN820	2	230	1182	5.24CF	4"	74dB	175lb	9	\$330
Reliant	NN830	3	230	1883	10.48CF	4"	82dB	178lb	9	\$500
Sears***	299780	1	115	408	4CF	4"	83dB	69lb	6.5	\$280*

*These models come complete with a section of hose. **Delta also provides an 11-square-foot bag. ***Sears includes a reducer and a vacuum hose for the reducer.

since Trend-Lines sells names like Delta, but the risk paid off. All three of these units are winners and worth a close look. We tested 1, 2 and 3 hp units with comparable results. They ran quietly and filtered excellently.

The 1 hp is good enough to handle anything that a single machine can throw at it, and the 3 hp collector will suck your skivvies right off you if you're not careful with the intake hose. Another variable here is bag capacity—from 2.1 cubic feet for the smallest unit up to a whopping 10.5 cubic feet for the papa bear. You'll need 230-volt power for both the larger units but since either one can handle more than one machine at a time, the collector involved will probably remain in a fixed position, making for easy hard wiring.

These units have extremely beefy motors. We threw everything short of large logs into these machines and all passed with

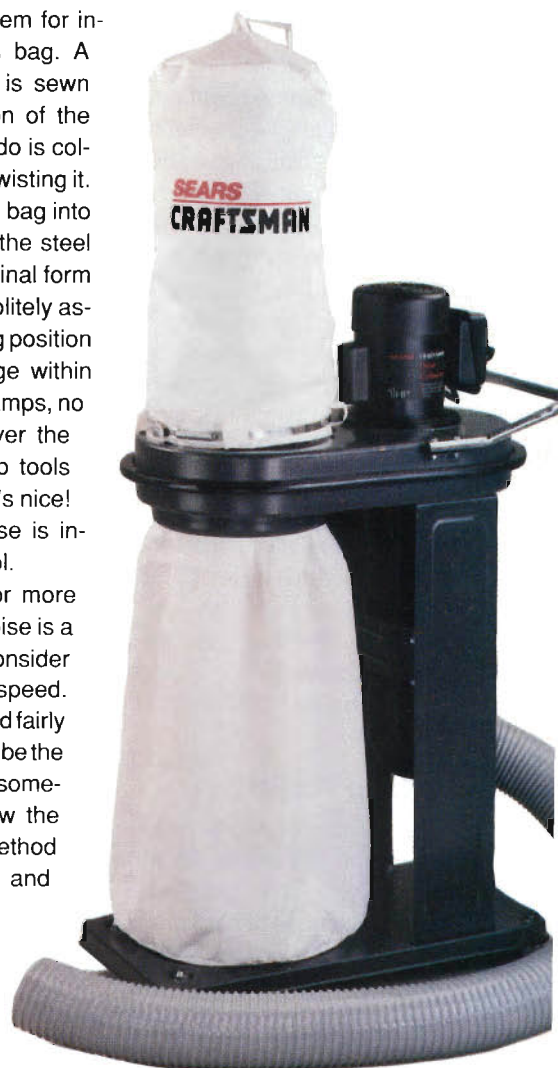
flying colors. Ironically, both of the large units come with casters, but after you pass a certain threshold on size and horsepower, it just isn't feasible to push these beasts around the shop. It's good to see an import that's built with attention to detail and materials. (Trend-Lines, 375 Beacham St., Chelsea, MA 02150. Tel. 800-767-9999)

Sears Model 299780

This machine was a bit underpowered for its class but is adequate for one-machine-at-a-time operation.

It has a great system for installing the debris bag. A spring steel band is sewn into the top portion of the lower bag; all you do is collapse the steel by twisting it. After you insert the bag into the bottom chute, the steel remembers its original form and twangs as it politely assumes its operating position on an interior ledge within the housing. No clamps, no bags to stretch over the outer drum and no tools required. Now that's nice! A good 5-foot hose is included with the tool.

We still wish for more suction, and the noise is a bit high when you consider the lower intake speed. But it's well-built and fairly compact. I wouldn't be the least bit surprised if someone tried to borrow the bag attachment method from this machine and apply it to another make. (Sears stores throughout the United States) **DW**





Pecan

by Ken Textor

Pecan trees are probably better known for their nuts than for their handsome wood. In fact, if you've ever tasted pecan pie, the unofficial "dessert of the South," you might wonder why anyone would turn such a delicious nut-bearing tree into lumber. But don't worry, pie lovers and woodworkers, there are more than enough pecan trees to keep both markets happy. For woodworkers, though, finding true pecan lumber—depending on the region of the country—may be more difficult than finding the nuts.

General Description

True pecan is one of eight major species that fall into the genus *carya*, which are commonly called hickories. The genus is divided into two groups based on the nuts each tree bears, its wood properties and where and how the tree grows. For the woodworker, though, these categories can be a confusing nightmare at the lumberyard.

Butternut, nutmeg, water and true pecan fall into the pecan group of the hickories, whereas shagbark, shellbark, pignut and mockernut are classified as true hickories. But often you'll find all types mixed together and sold generically as "pecan," or "hickory," or even "pecan hickory."

Telling the difference between pecan and true hickory can be difficult. In general, both have a white-to-cream sapwood with a reddish-brown heartwood. Pecan will generally have darker heartwood with more figure to it and a larger, more pronounced grain. You'll find dark-brown streaks, or small bird-pecking marks, or grain swirls in pecan heartwood, while hickories tend to have a more uniform, straighter grain and a lighter reddish-brown color. Hickories also tend to be heavier than pecan.

The wood of the pecan tree is tremendously hard, tough, strong and resistant to breakage. Unfortunately, pecan has a tendency to shrink quite a bit, so buy very thoroughly dried lumber and keep it dry (12% moisture or less) during the woodworking process. Even after a project is completed, it will shrink and swell quite a bit, particularly in changeable climates. Pecan also has a very poor ability to resist rot, and its sapwood attracts powder-post beetles.

Working Properties

Pecan is traditionally used in paneling, flooring, dry goods kitchenware and tool handles. But it's also used in fine furniture, sometimes as solid lumber but most often as heavily figured veneers. Because pecan lumber often comes through the milling process in lower grades, you'll see it used as pallet stock and in loose cooperage.

When bent, pecan resists breakage well, but the wood's

tendency to shrink makes it a questionable candidate for bent-wood furniture projects. Furthermore, the steaming process takes quite a bit longer than with other hardwoods.

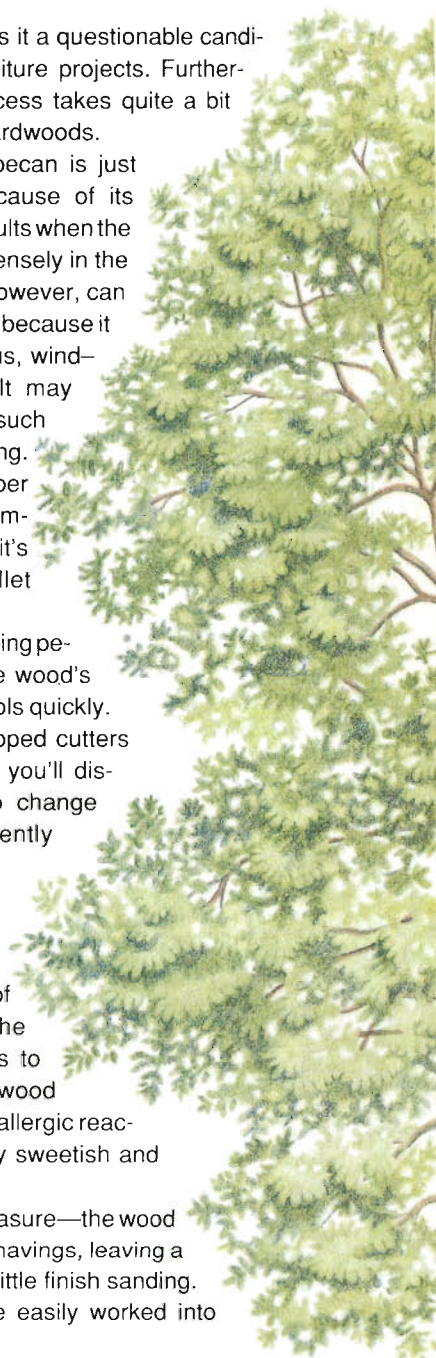
Planing high-grade pecan is just about problem free because of its straight grain—which results when the trees grow quickly and densely in the wild. Cultivated pecan, however, can have a fairly twisted grain because it grows in a more spacious, wind-exposed environment. It may pose planing problems such as raised grain and chipping. But cultivated pecan lumber seldom reaches the commercial market, and then it's usually turned into pallet stock.

Cross-cutting and ripping pecan is easy although the wood's hardness tends to dull tools quickly. I recommend carbide-tipped cutters whenever possible, and you'll discover that you need to change sandpaper more frequently than usual.

Sanding pecan is easy owing largely to its hardness and ability to resist sanding dips. Because of the heavy nature of the wood, sanding dust falls to the floor quickly. The wood does not produce strong allergic reactions and it smells faintly sweetish and nutty.

Turning pecan is a pleasure—the wood comes off easily in fine shavings, leaving a surface that needs very little finish sanding. Very fine details can be easily worked into turned surfaces.

Fastening pecan presents some challenges. Do not expect to nail or screw anything into it without the correctly sized pilot hole. Use a wax or soap-based lubricant on the screws to prevent twisting the screw head off. In exchange for your efforts, though, you'll find pecan fastenings last forever. This wood rates among the highest in domestic hardwoods tested for



their ability to hold fastenings.

Gluing pecan presents no significant problems. All the resin-based liquid glues work well, and epoxies bond well with pecan's porous surface. Glues should be used sparingly, however. Pecan's open pores are a catch basin for glues and stains which may show up later when a finish is applied to the wood.

Finishing

Pecan requires a little extra attention in finishing, depending on the effect you want. If you want a completely smooth surface, a filler will be required to deal with the wood's very open grain. You can use various colored washes, glossy enamels and stains to heighten the open-grain look of pecan. Since pecan is a relatively rare hardwood in most parts of the United States, however, you may opt to see that unique reddish-brown coloring without adornments. Be sure, then, that the clear finish you use will not yellow. Most polyurethanes—both oil and water based—will let pecan's true colors shine through without yellowing.

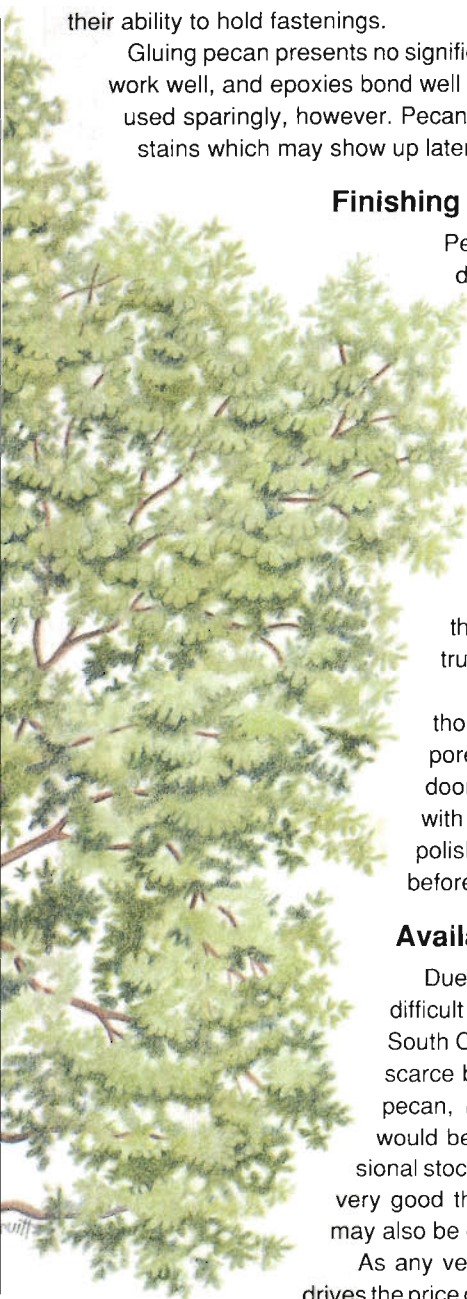
Waxes and oils also work well in pecan, although oils can allow dirt to build up in the open pores. This is particularly true on items like cabinet doors that get a lot of hand traffic. When finishing with wax or oil, it's best to work the surface to a high polish—ending with up to 600-grit sandpaper—before applying the finish.

Availability

Due to its limited growing range, you may find it difficult to obtain true pecan in areas outside of the South Central states. Very long or extra-wide stock is scarce because of local sentiment about the value of pecan, not to mention the shrinkage problems that would be compounded by large planks. Large dimensional stock is almost unheard of, but veneer supplies are very good throughout the United States. Pecan plywood may also be difficult to find outside the Mississippi Valley.

As any veteran woodworker might expect, this scarcity drives the price of pecan up. Outside of its natural growing area, you can expect to pay four to five dollars a board foot. In its native areas, you can knock a dollar or two off the price.

Fortunately, there is no waste for woodworkers when using pecan. Even chips from the planer will be highly prized by smoked food aficionados, and short cutoffs make excellent candidates for small kitchenware items. As a woodworker and wanna-be gourmet, I can think of nothing better than a meal of pecan-smoked salmon on pecan plates that I turned myself, topped off with—you guessed it—a plate of pecan pie. **PW**



SCRAP SOLUTIONS

HONORABLE
MENTION

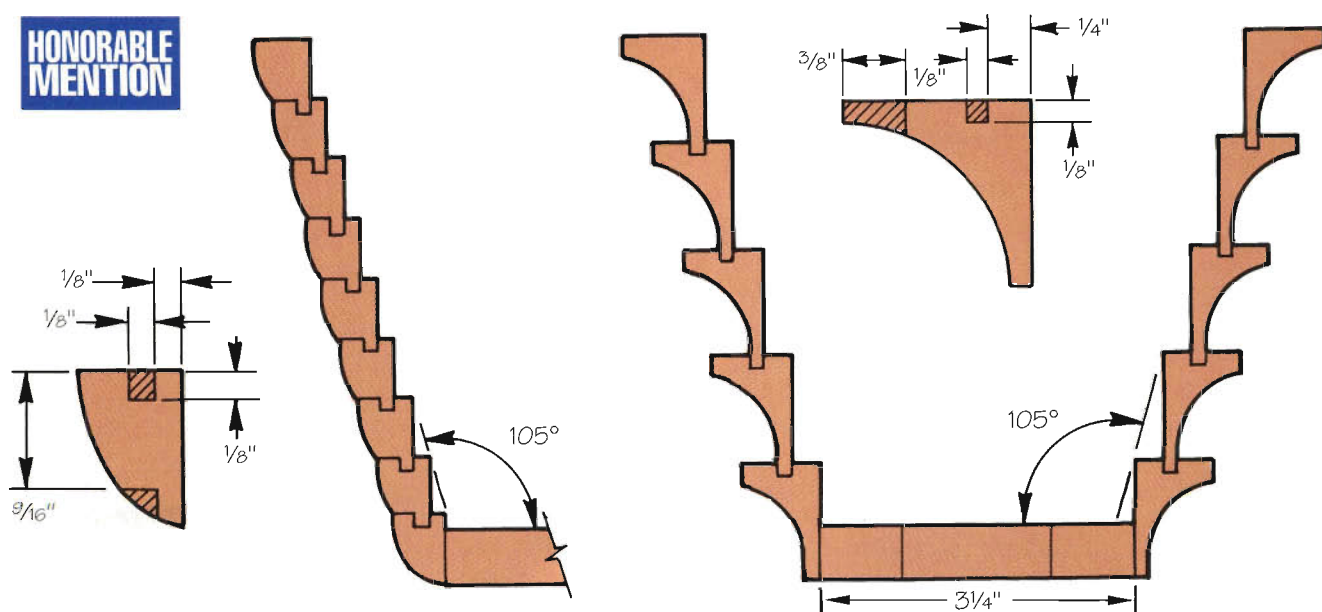
Maybe I'm getting cheap in my old age but anything over 12" long in my shop is still considered useable and only the *chunks* are what I call scrap. To make these critters simply cut moulding slices $\frac{3}{8}$ " to $\frac{1}{2}$ " thick and use some imagination and

a little hot glue. The movable legs are drilled for a small nail or some soft wire. I used mostly baseboard but also cove and a few rectangular pieces.

Keith Brown, Covina, CA

Cove and Quarter-Round Planters

HONORABLE
MENTION



Coves and quarter-rounds are common mouldings—scraps are usually easy to come by. Here's a plan for a hexagon or octagon flower pot holder, or if inverted a decorative plant

stand. You'll need about ten feet of pieces of $1\frac{1}{8}$ " moulding and a $\frac{1}{2}$ " or $\frac{3}{8}$ " plywood base for each planter.

William Siehr, Manitowoc, WI

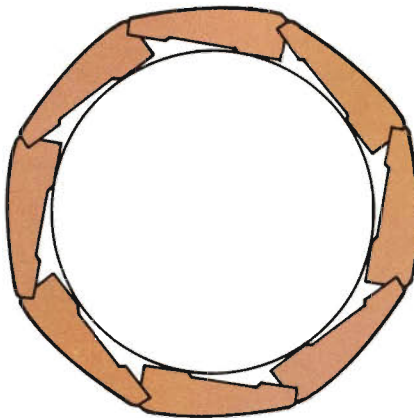
Bits, Pieces, Chunks...

There were two things that became apparent from the replies to Scrapwood Challenge #3—that there is no such thing as scrapwood (maybe a few bits of firewood) and that you all have a lot of molding pieces sitting around your shops.

The varied shapes and profiles of molding available made this challenge particularly interesting because everyone was working from different kinds of stock. Some entries used the factory shapes as decorative element, some for structural reasons, some payed no attention to the curved profiles of their wood.

We chose the wren house on page 97 as the winner because of its classic styling, simplicity of design—and of course good photos never hurt.

All published projects get a one-year subscription. Honorable Mentions get an 'embossed back issue binder and a PWT-shirt! The winner will get a new power tool (and the T-shirt and binder too)!



Pedestal Plant Stand

The body of this column is made from eight strips of modern door casing 17½" long. There are sixteen pieces of decorative molding around the top and base of the stand and the grooves, or flutes, were cut on the table saw with a moulding blade. The base and the top are made of ¾" plywood trimmed with decorative moulding.

Dan Breuker, Jenison, MI

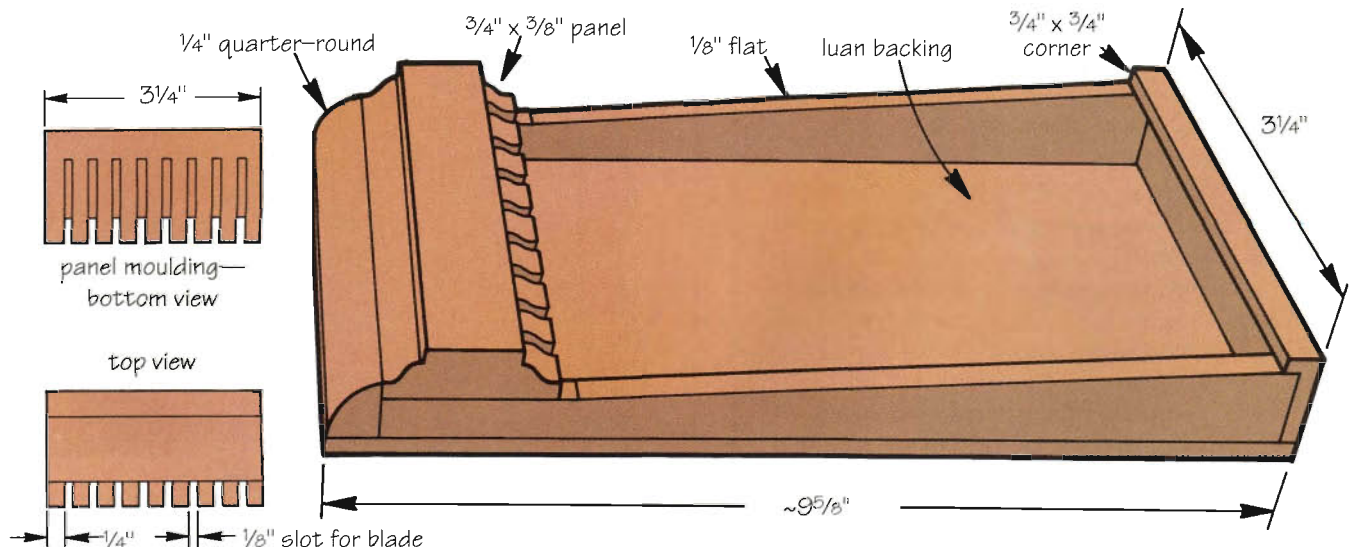


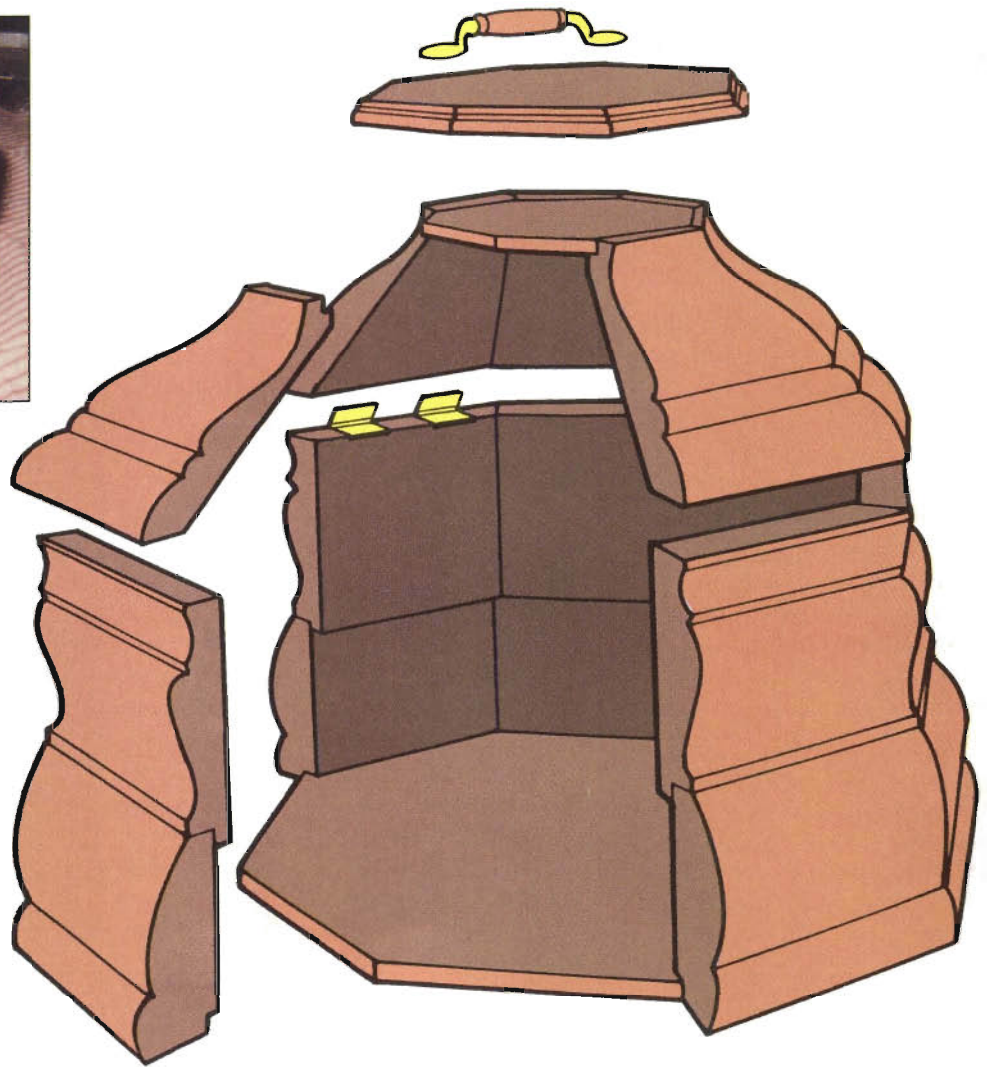
Steak Knife Holder

Over the years my kitchen flatware drawer has become the final resting place for miscellaneous steak knives. One day I had enough of the clutter and decided that I had better organize them. As a result I sketched up this steak knife holder. It was a simple enough task once I had grouped the knives into piles of the same relative size. The construction is

very basic. I used various types of scrap moulding which I had accumulated over time. It consists of quarter-round, panel, flat, and corner guard mouldings. The assembly was accomplished with wood glue and some small clamps. Now my steak knives are sorted and out of the way.

Jim Raevis, Fair Haven, NJ





**HONORABLE
MENTION**

Colonial Tea Chest

My project is a tea chest made from scrap lengths of oak crown moulding. A local specialty furniture shop discarded 8" to 12" lengths from time to time, and I was able to develop the basic shape of the chest by modifying the widths of these scraps.

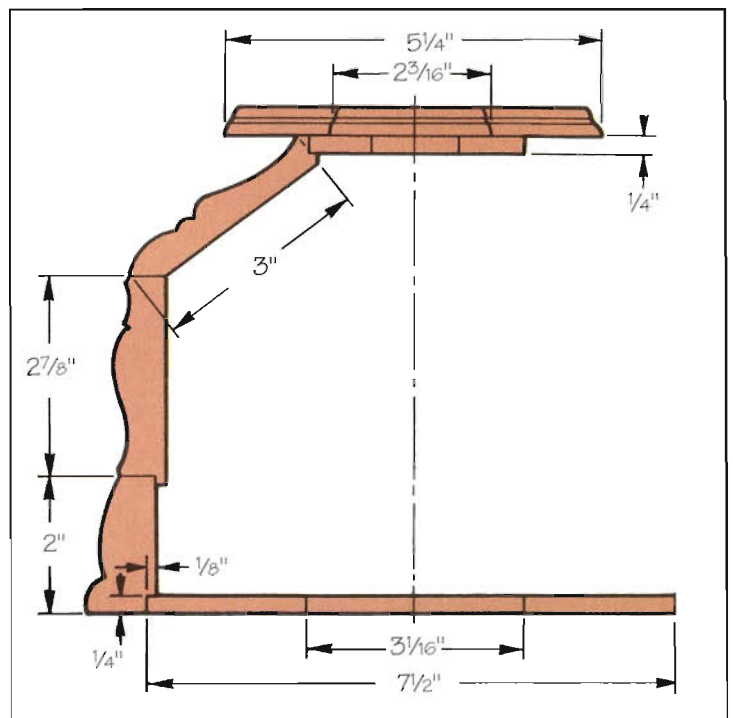
The most critical aspect of building the project is to make each section its exact length with each face at $22\frac{1}{2}^\circ$.

It might be necessary to modify your dimensions somewhat from the plans given, depending on the moulding available.

I used a hot glue gun to tack the side together to check for fit before assembling permanently with glue. (Make sure to remove traces of the hot glue before final assembly.)

The top handle is a standard drawer pull shortened in length by cutting a section out of the center and reassembled with epoxy. This is then attached to the top with the original screws.

Frank Vecchio, Piscataway, NJ



Twelve Year Old Zebra

Eldon Soward of Lake Preston, SD says that his work area keeps getting smaller due to his appreciation of the finer qualities of cutoffs and small pieces of wood. Eldon saved the zebrawood for the top of this box for over twelve years.

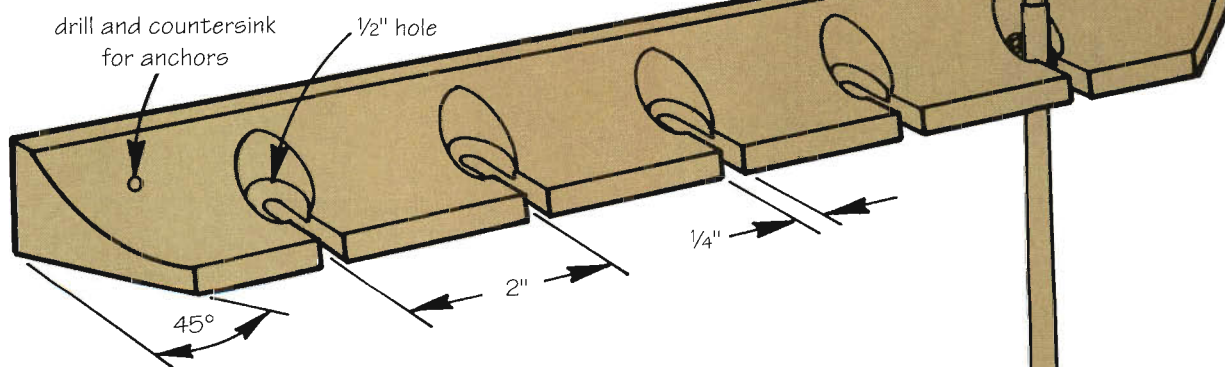


Muddy Shoes

Nathan Schulde from New Hartford, CT sent this response to the Scrapwood Challenge. It's a doormat made from moldings left over from his furniture production. Each strip of moulding has two lines routed in it with a veining bit for the decorative pattern and to help loosen dirt from shoes. Both sides are faced so that either can be used for the top and the wooden mat is finished with deck stain for durability.

Fishing Rod Rack

I had some $\frac{3}{4}$ " cove moulding left over from residing my house. I used it to make a simple and quick fishing rod rack. Lay out across the cove side as many holes as you like, spacing them equally and $\frac{3}{8}$ " from the back. I've found 2" between holes works well so the fishing reels don't hit each other.



Drill out the holes using a $\frac{1}{2}$ " Forstner bit, leaving a flat bottom on the cove. Next, drill a $\frac{1}{4}$ " hole through the center of the $\frac{1}{2}$ " hole. Draw lines on each side of the $\frac{1}{4}$ " hole to the front lip of the moulding and cut this segment out. Drill and countersink two mounting holes and cut a 45° on each end and your rack is done.

Ted White, Coon Rapids, MN



Twenty Tons of Bits and Pieces

This table, chairs, candle holders and napkin ring were made by **Robert Dowson** of Ottawa, Ontario who says there is no such thing as scrapwood—out of respect for the wood we should call it bits and pieces. Well, Bits and Pieces Challenge doesn't have quite the same sound as Scrapwood Challenge so we'll continue with the present terminology. The stock for these entries came from a Canadian government donation of twenty tons of bits and pieces of moulding to Mr. Dowson's senior woodshop (all that and national health care too?).



**HONORABLE
MENTION**

Kindling?

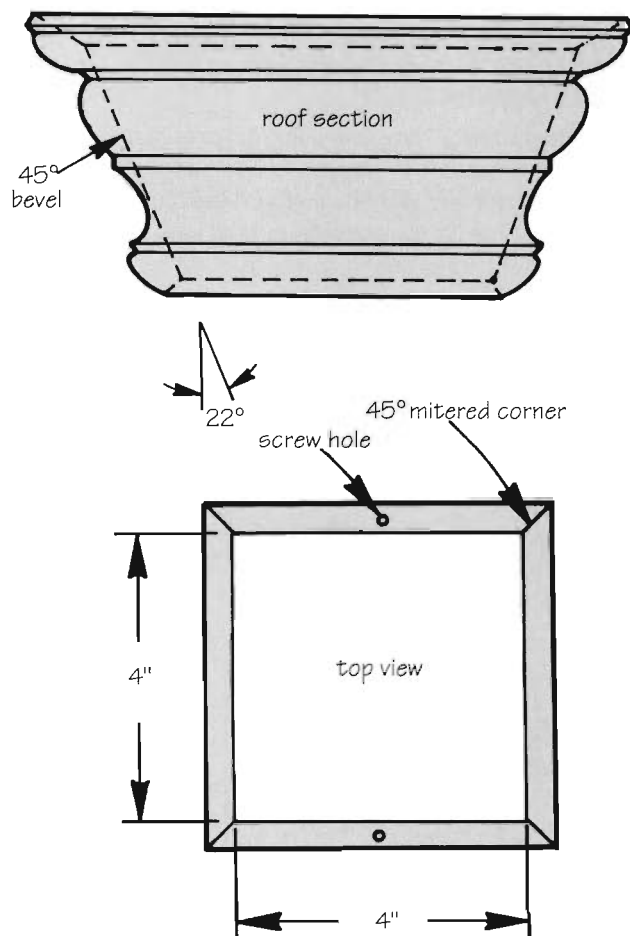
While some entrants said only their smallest scraps were fit for the fireplace, Mr. Van Hoff says that he uses these pieces to build a fireplace.

A while back my wife asked me to make some doll furniture for the grandkids doll house. A couple of the pieces I made used scrap moulding. The fireplace and table are made from four pieces of scrap, mitered to 45° and glued together to form a block. Make these pieces any size you want, but make several because everyone will want them. They're hot little items at craft shows.

Tom Van Hoff, Le Mars, IA



Either Dan's got wrens in his den or this photo is a good illustration of both primary and "scrap" use of crown moulding.



The Winner

Wren House

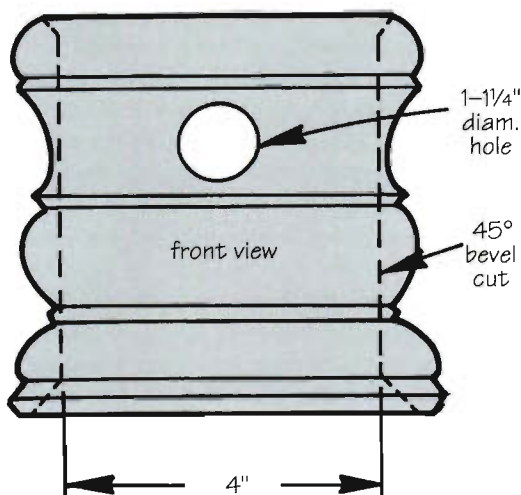
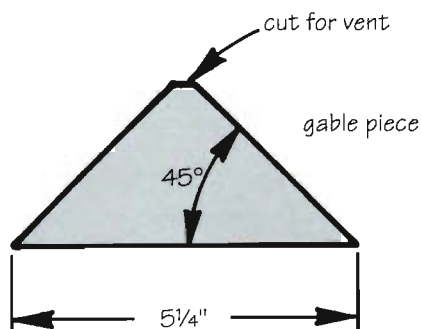
Thanks for the challenge. It led to the easiest birdhouse I've ever built. It only took one hour to build and paint.

This wren house was made with 5 1/4" colonial crown moulding. The inside dimensions are 4" x 4" with a 1" to 1 1/4" hole for the birds to get in and out.

My table saw remained at the same 45° setting for all cuts, including the bottom piece that I made from a 3/8" piece of mahogany. The bottom is held in with two brass screws for easy cleaning of the inside of the house.

Leave small air gaps under the eaves and at the gables for ventilation.

Dan Closs, Oakland, MI



The Grand Prize: Skil 3380 5 Speed Drill Press

The grand prize for Scrapwood Challenge #3 is Skil's Benchtop 8" Drill Press. This versatile tool has a cast iron base, tilting table and adjustable stop for precise depth measurement.



Scrapwood Challenge #5

Our fifth scrapwood challenge is to make use of rough 2X12's, 12" to 30" long.

Send your ideas by July 22, 1992 to; Challenge #5 1320 Galaxy Way, Concord, CA 94520. Don't forget to include a dimensioned sketch, instructions and cutting list if applicable. A good photo of the project will greatly help your chances. Entries become the property of *Popular Woodworking*, and the decision of its editors is final. Notification of winners will be by publication in the November 1992 issue.



Cold Turkey

We have an ironclad rule in our shop—No Smoking Around Flammables—and that includes wood flour suspended in the dry *shop air*. One way or another, the nerd with a hot butt in his hand is going over the fence. If the spray booth doesn't go sky high, and the mill with it, I'm going to throw him over the fence, with his lips tied in a knot around the offending cigarette.

A while back I took on a partner to expand the shop. I didn't know Jimmy was a nicotine slave. There he was at the sander with a cigarette hanging from his lip, and the No Smoking sign dangling like the sword of Damocles over his head. I snatched the butt from his mouth and ashed it out very carefully in his ear. "No smoking!"

"What's the harm? This isn't the spray booth," he whined.

I removed the pack from his shirt pocket and offered to put one, lit end first, right up his nose. "Calling the fire department is way down on my list of priorities—I have higher aspirations. I'll help you quit if you like."

"You're serious, aren't you?"

"Like a heart attack, if you get my drift."

"All right," he grumbled. "You drink coffee and spilling that on a fresh lacquer finish would really mess it up—why don't you quit drinking coffee?"

"Because coffee doesn't burn! Quit smoking!" I hollered,

getting right in his face. He cowered a bit as he realized how serious I was. "If you want, I'll help you quit."

"All right! Keep your shirt on! I'll quit, but not cold turkey. Find me a safe smoking area and I'll cut down gradually to nothing. Okay?"

I set up a smoking area out of harm's way, but I knew it wouldn't be enough. When Jimmy came in, I handed him a package of his favorite brand. "There's a red ink band around each of these cigarettes. You get three safe puffs, and after that, anything can happen."

He glared at me, like Hirohito glared at MacArthur during the big surrender. "Three puffs?"

I nodded. He lit up. Three puffs and BAM! "Nothing dangerous, just a little cigarette load."

The next three days didn't go well. Eight loads didn't faze him, although two had full-sized firecrackers and one had a little silver cylinder that looked dangerously like a blasting cap. He remained unswayed, but rather than put up with a six-foot-five heavy-duty highly aggressive ex-Marine D. I. with a bad attitude toward smokers, he let up a bit.

He still sneaked a puff now and then, so mere threats to life and limb were not enough. No more Mr. Nice Guy! It was time for research, application of experience, and ruthless imagination. It bore fruit the next day.

He slammed the door with the greenest look on his face I've ever seen this side of terminal seasickness.

“Horsehair?”

The next few days saw wholesale violations of the Geneva Convention. A neighboring business wondered aloud if we were testing chemical weapons, and I was unable to dispute the charge—some of those cigarettes smelled worse than newlyweds trying to cook. The local petition drive demanding that I let up on Jimmy failed to make the general election, but the EPA started setting up toxic chemical warning signs whenever Jimmy lit up. This all happened before I decided to escalate.

What next? Should I send low-level saturation bombing sorties against his house—or nuke it? Maybe missionaries from the Church of Religious Consciousness could talk him down. Naw...I decided to get rough—tie the varmint to a chair and read him selected verses from my best original poetry!

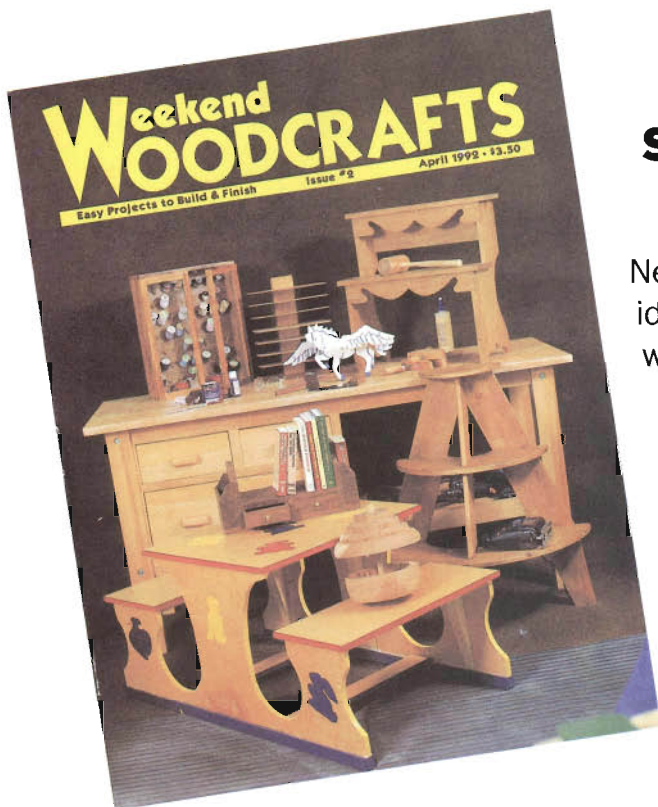
Finally, and not without pain, Jimmy quit smoking—and I was never so sorry in my life. When would I ever again find anyone who needed that much straightening out!

But just when I thought it was all over, Jimmy started returning my volleys with his own unwarranted, spiteful and personal attacks. He had the unmitigated gall to suggest that now that he had quit smoking, my nauseating and unhealthy habit of drinking coffee ought to be the next to go! I like my coffee—no, I need my coffee! Cigarettes, my eye! This means war!

You know, that last cup of java didn't taste quite right. PW



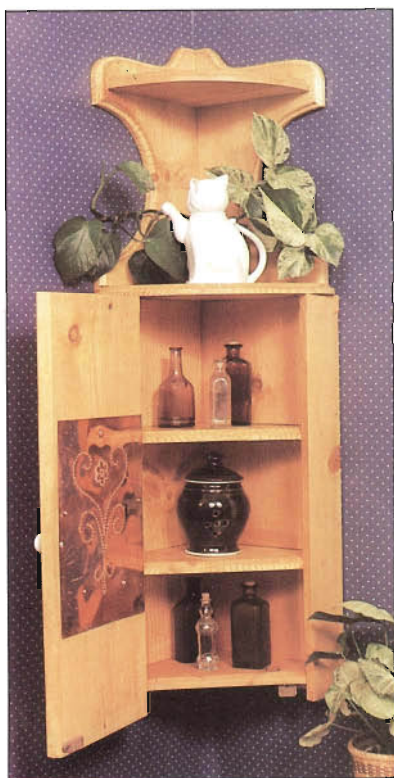
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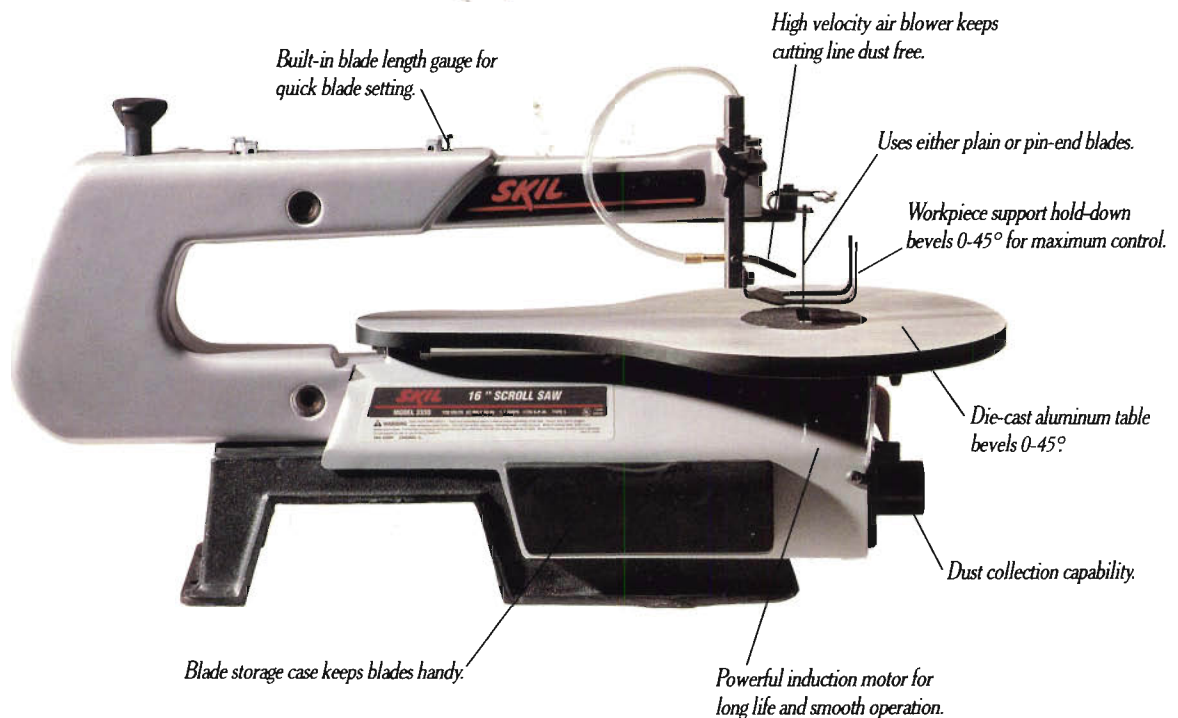
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